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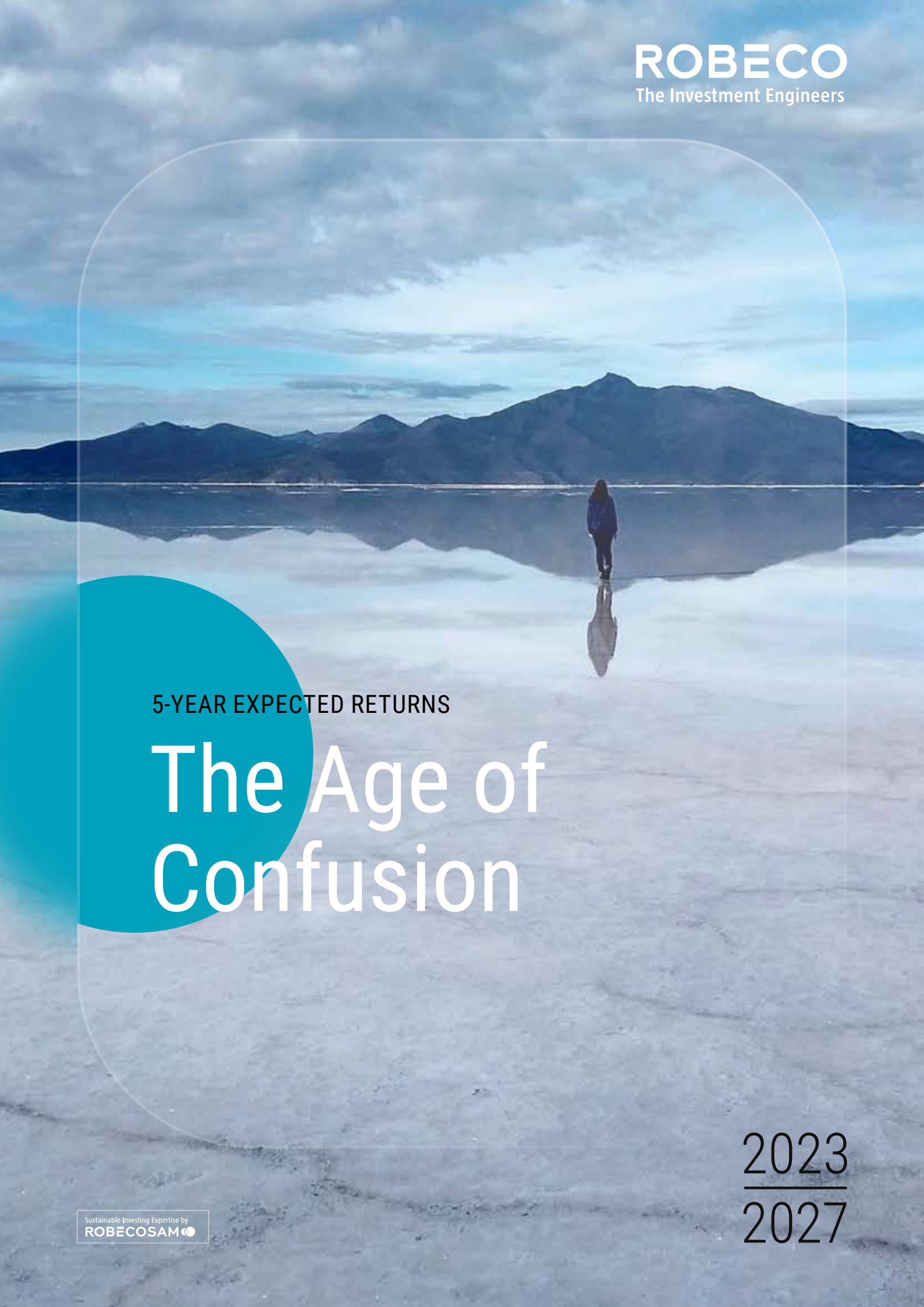

5-YEAR EXPECTED RETURNS

The Age of Confusion

2023
2027

Sustainable Investing Expertise by
ROBECOSAM

5-YEAR EXPECTED RETURNS

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2023
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This document has been compiled by Laurens Swinkels and Peter van der Welle (August 2022). It represents the views of Robeco's Multi-Asset team, which are not necessarily shared by other teams at Robeco.
Please visit www.robeco.com/expectedreturns for more information.

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For an assessment of the long-term expected returns,
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Contents

Foreword

They say the most dangerous words in finance are "This time it's different". Yet, while writing this twelfth edition of our annual five-year outlook, we realize that many institutional investors may have difficulty resisting Wall Street's most infamous behavioral trap. We've faced exceptional bond market volatility, geopolitical upheaval and a US back-to-back quarterly GDP contraction in the first half of 2022 that likely isn't an NBER recession. Paradoxes abound. While corporates have been posting healthy double-digit earnings growth so far, consumer confidence has plummeted to historical lows on the back of surging inflation.

As we know, history often rhymes, but it does not repeat itself. Therefore we should be careful not to pick and extrapolate one particular historical period as a template. The early 1920s, the late 1940s, the 1970s and the 1980s: all these periods have something in common with the present, and the future is likely to be a diffuse amalgamation of them all. It's not so much that this time it's different, but that the future feels somehow darker and harder to fathom than usual.

This year's theme, The Age of Confusion, brings back memories of the 1986 Genesis song *Land of Confusion*. The song was written at a time when geopolitical risk was also elevated, as reflected in the lyrics and the video featuring puppets from the famous *Spitting Image* satirical news show. The theme also brings to mind the book *Confusion of Confusions* by Joseph de la Vega, the son of a Jewish refugee from Spain who settled in Amsterdam and described how one of the first financial markets functioned in the seventeenth century in the Netherlands.

Back then, data was scarce, which easily wrongfooted investors who had to act on rumors. In this day and age, data is plentiful, and the key is to uncover its materiality for the investment process. In one of this year's special topics, we therefore reflect on the role that traditional and alternative data play in investment decisions.

Expected returns are a vital element of any investor's strategic decision-making. The approach we take in this report is, as always, based on a five-year outlook, extending to 2027, and our forecasts can be used as input for the investment plans of both institutional and professional investors. We pair our return forecasts for all major asset classes with related content in order to provide readers with a deeper understanding of the markets in which they are investing. An example of this is our chapter about the effects of climate change on expected returns, which we introduced last year.

For over 90 years, research has been at the heart of Robeco's investment strategies and that is why we have included numerous references to academic and non-academic publications for readers wishing to delve deeper into the topics discussed. Our research mindset is also exemplified by our recent effort to provide investment strategists and academic researchers with open access to some of our sustainability data.

We hope that you enjoy reading this publication and find it helpful in navigating the investment landscape in the confusing times ahead.

Victor Verberk
Chief Investment Officer Fixed Income and Sustainability

EXPECTED RETURNS 2023-2027

1. Executive summary

Around 1720, Johann Sebastian Bach, arguably one of the greatest classical composers of all time, wrote a remarkably complex fugue in B minor that not only has four voices but also features a theme using all twelve pitches of the chromatic scale, unprecedented at the time. With the theme covering all notes in the octave, the fugue appears to completely lack harmony, which was why one of Bach's contemporary critics dismissed the fugue as "confused". Yet it turned out to be revolutionary. Bordering on atonality, it hinted at a major paradigm shift in music that would not occur until two centuries later, when Arnold Schönberg drew inspiration from this fugue to compose atonal music, abandoning the well-established realm of tonal music.

Bach's fugue resonates loudly in today's financial markets. Given the multiplicity and persistence of recent shocks, a feeling of disorientation resounds in skyrocketing bond market volatility on the back of the highest US inflation and the lowest Chinese GDP growth in 40 years. Like the four distinct voices of Bach's fugue, the orchestra of financial markets has been playing four different regimes in rapidly alternating fashion this year. Year to date, we have observed rising nominal Treasury yields and falling credit spreads (risk-on regime), declining Treasury yields and rising credit spreads (risk-off regime), rising Treasury yields and credit spreads (QT regime) and declining Treasury yields and credit spreads (QE regime).

Last year's 5-year outlook, entitled The Roasting Twenties, was subtitled "Things are heating up". Unfortunately, one year later we have to conclude that things have been heating up pressure-cooker style, not only because of global warming. A hot war in Europe triggering an energy crisis, a food crisis, and inflation in developed economies hovering around double digits were clearly not penciled in. While Covid appears to be on its way to becoming endemic, it is still hounding the largest contributor to global growth, China. A country that is also simultaneously battling a real estate crisis as well as drought.

The age of confusion is all about multiplicity, persistence and reflexivity

In our view, we have now entered the age of confusion. Confusion because of the many moving parts that market participants have to juggle, creating larger divergences in analyst views than usual around critical signposts such as the effectiveness of monetary and fiscal policy, climate change, the impact of energy and food prices, China's growth trajectory, debt overhang, zombification, and geopolitics. This heightened uncertainty is reflected in volatility almost doubling in analyst forecasts of 12-month forward global earnings estimates compared to pre-Covid levels. This age of confusion is being driven by the multiplicity of recent shocks, the persistence of the shocks, and reflexivity, the reaction to the shocks. We see the confusion or disorientation mainly in three key areas: the lack of understanding about inflation, the shift in monetary policy, and the ongoing debate about whether the Great Moderation has ended.

Understanding the lack of understanding about inflation

First, there is confusion about the origin of inflation and critically so in central bank circles. While Powell said in early 2021 that we should perhaps "unlearn" the monetarist textbook relation between monetary aggregates and output and inflation, other central bankers or former central bankers like Mervyn King disagreed, and held that Friedman's famous quip that "inflation is always and everywhere a monetary phenomenon" is still valid and that central banks should not have printed the extra money in the wake of the Covid recession. As we show in Chapter 4, unlearning Friedman seems unwise even if the velocity of money is low.

Naturally, there is also confusion about the inflation trajectory ahead. Central bankers' judgment last year that inflation was going to be 'transitory' has clashed with reality. Powell had to concede that "I think we now understand better how little we understand about inflation". Major central banks have fallen prey to the same misconception in their forecasting, where just stating an inflation target you then allow your models to run on the assumption that inflation in the long run will always come down to 2%. In doing so, central bankers have been whacking at the ball and missing it in the post-pandemic recovery, ending up behind the curve. Ultimately, central bankers are not only taking the risk that the so-called 'expectations channel' for monetary transmission will collapse if inflation expectations were to become unanchored, but also their own credibility as inflation fighters. This year, central bankers have clearly acknowledged that risk by scrapping the word 'transitory' from their vocabulary and embarking on a fast-paced tightening cycle.

In last year's publication we warned that "inflation may prove less transitory than assumed", predicated on the view that the historical high macro uncertainty emanating from the Covid shock presented a prolonged, more persistent period of economic rebalancing. Reassuringly, rebalancing is already under way, with easing supply chain pressures visible in declining freight fees as well as declining core goods prices. On the demand side, the excessively strong goods consumption during 2020/2021 has normalized. Real oil prices have come down and with base effects from decelerating year-on-year oil prices in headline inflation becoming more pronounced, life should become a bit easier for central bankers.

Yet, there is an obstacle. At this stage, base effects from energy prices should have already led to declining overall CPI numbers but these effects have been subsumed by reflexivity[1]: as the facts about the cost of living change, economic participants respond and start demanding compensation via wages and indexation of pensions. Reflexivity suggests that after peak inflation, the emerging process of disinflation could be erratic and does not automatically imply inflation will fall neatly towards central bank inflation targets. Even as the exogenous inflation shocks (food/energy) fade into 2023, the response from domestic producers and consumers creates endogenous effects with domestic inflation sources picking up (services, rents).

1. A term introduced into the economics discipline by Soros in his book "The alchemy of finance" (1987).

Thus, the emergence of disinflation still does not resolve the question of where inflation will land in the medium term. After financial markets were surprised by both the multiplicity and persistence of shocks in 2022, reflexivity might be a new element that could prolong an episode of confusion about inflation against a backdrop of increased bargaining power of labor versus capital. Although we find that the bar for inflation becoming entrenched is pretty high and recessions, which we expect one way or another in each scenario, are highly disinflationary, a right-hand skew to the expected inflation frequency distribution for developed economies is a key thread for 2023-2027.

A landmark shift in monetary policy

The second reason why we are entering the age of confusion is that a major regime shift for financial markets is getting traction with the transition from QE to QT by central banks. The reason for this shift is that inflation risk premiums tell us that the decade-old deflation scare has reversed into an inflation scare, removing the need for artificially low interest rates and unconventional easing measures. We are sailing largely unchartered waters here. Accustomed to the Fed put, markets have been interpreting bad macro news as good news as more easy money was on its way. A whole generation of traders, and algos for that matter, has now been conditioned on central bank balance sheets trending up as a percentage of GDP. This uptrend has caused massive asset price reflation. Note that, despite the significant multiple compression observed over the last year, the S&P 500 standard price-earnings ratio is still up 97% since former Fed president Bernanke first

announced QE in November 2008. As the trend of central bank balance sheet expansion is about to reverse, it is simply too easy to assume that QT will be the mirror image of QE and therefore everything is already fully reflected in current pricing. The experience of the mild QT period 2017-2019 in the US has already shown that the impact on liquidity conditions is asymmetrical to the downside. In a world where inflation risks are tilted to the upside, bad macro news will be simply bad news after all.

Farewell to the Great Moderation?

Thirdly, the multiplicity, persistence and subsequent reflexivity emanating from recent shocks has triggered a major macro debate on whether the Great Moderation has ended. While confusion itself could be indicative of a nascent paradigm shift, it is not enough in and of itself. We find that the future has become less predictable and remain agnostic on regime change in the next five years, though it is clear that the Great Moderation is getting punctuated by bouts of a stagflation.

Major claims of paradigm shifts require a heavy burden of proof. We find insufficient evidence to conclude that we are close to a tipping point where reflexivity leaves inflation in developed economies spiraling out of control. If the ongoing demographic reversal in China, the largest contributor to global growth, ultimately proves to be net disinflationary as a prolonged deleveraging in its vast real estate sector results in subdued consumption growth, the Great Moderation could very well continue. If, on the other hand, overly growth-sensitive central banks pivot prematurely and abort the tightening cycle without taking the sting out of inflation as China recovers, we will likely inch closer to saying farewell to the era of the Great Moderation.

Our scenarios

Where does all this leave us with our scenario thinking? In our base case, **the hard landing that unstings inflation**, we envisage a global economy that undergoes a wobbly, drawn-out recovery after a US recession in 2023 cools demand enough to take the sting out of inflation. The Fed policy rate cuts during the next recession will have a hawkish signature nonetheless as inflation is expected to remain in the twilight zone (2.6% on average during 2023-2027). Investment activity towards restoring supply chains builds resilience but also compromises efficiency. Three engines, which historically are low real interest rates, level of excess savings, and housing affordability, that would be able to sustain above-trend consumption growth in the next five years for developed market economies have started sputtering. We therefore downgrade the US growth trajectory from 2.3% to a below trend 1.75% annualized real GDP growth in the next five years. Worsening demographics will decelerate China's real activity growth below 5%.

In our bull case, **The Silver Twenties**, we see a silver lining emerge from the recent multiplicity of shocks. We expect US real GDP to rebound to 3.75% in 2024 and see its 5-year geometric annualized GDP grow at a healthy above-trend growth rate of 2.75% in the 2023-2027 period. This is predicated on our view that innovations stemming from green capex and the post-Covid capex boom will finally start to appear in productivity data. The recently enacted Inflation Reduction Act in the US will create a cyclical upswing in green capex. Europe accelerates its move away from Russia as a major energy supplier via LNG import terminals and accompanying long-term LNG contracts and becomes strategically independent from Russia. At the same time, the REPowerEU initiative contributes to Europe's Fit for 55 goal. China manages to establish Covid herd immunity in 2023 as well as a controlled deleveraging of its real estate sector, enabling it to achieve the CCP's 5.5% annual growth target.

In our bear case scenario, **The Stag Twenties**, we foresee that the current global tightening cycle and the ensuing recession in 2023 are not enough to knock stubborn inflation off its

pedestal. In this scenario, myriad actual risks materialize as reflexivity abounds, both in financial markets as well as the real economy. Echoing the Volcker-led Fed back in the 1980s, two recessions are required to tame inflation. The Fed shows a heightened sensitivity to growth as it progresses in the ongoing tightening cycle and cuts policy rates for the US deeper in the 2023-2024 recessionary episode compared to our base case. The recession is nonetheless longer as consumer confidence does not recover as quickly as in the other scenarios because of high experienced inflation.

With supply side issues lingering against a backdrop of heightened geopolitical tensions, core inflation accelerates again to 4.75% by 2025. This now starts to greatly worry the Fed and it embarks on an aggressive tightening cycle. Yield curves invert again and another, deeper, recession unfolds around 2026/2027. The 5-year geometric annualized GDP growth is at the lower end of its historic range, with the US GDP growth rate only 0.95% in the 2023-2027 period.

From the current juncture, it is entirely plausible to see more extreme and divergent scenarios transpire in the next five years, ranging from outright deflation after a hard landing to an economic situation where inflationary psychology settles in, thereby reaching a tipping point where inflation spirals out of control. Yet, though plausible, such states of the world have a low likelihood in our view and present highly unstable equilibria.

Low to negative real returns, subdued risk premiums

How does an investor prevent deflection in the age of confusion? By looking at developments through the lens of multiplicity, persistence and reflexivity. Confusion in financial markets is nothing new, it has actually been a fact of life for investors since the very beginning, as evidenced by La Vega's 1688 book entitled *Confusion of Confusions* about the world's first stock exchange, in Amsterdam in the seventeenth century. Confusion creates opportunities for active investors. From a financial market perspective, the age of confusion could very well end up as the age of alpha opportunities for skilled active investors as the tide of excess liquidity that allowed for easy money trades recedes.

We expect asset returns in euro to remain below their long-term historical averages over the coming five years, mainly due to the below steady state risk-free rate and, in some cases, subdued risk premiums, except for commodities. For US dollar-based investors with an international portfolio, perspectives are more rosy as we expect other currencies to appreciate against the US dollar with the US dollar bull market coming to an end in the next five years.

We have reduced the expected return on equities slightly by 0.25%, leading to a 4% geometric total nominal return on a developed equity market portfolio in euro. The surge in nominal risk-free interest rates since September 2021 has resulted in an upgrade of returns for many fixed income asset classes with a notable upgrade of 1.5% for developed market sovereign bonds (hedged to euro).

Table 1.1: Expected returns 2023-2027

	5-year annualized return	
	EUR	USD
Fixed income		
Domestic cash	1.00%	2.50%
Domestic AAA government bonds	-0.50%	3.25%
Developed global government bonds (hedged)	1.00%	2.50%
Emerging government debt (local)	2.75%	5.75%
Global investment grade credits (hedged)	1.75%	3.25%
Global corporate high yield (hedged)	2.75%	4.25%
Equity		
Developed market equities	4.00%	7.25%
Emerging market equities	5.25%	8.25%
Listed real estate	3.75%	6.75%
Commodities	4.00%	7.00%
Consumer prices		
Inflation	2.25%	2.75%

Source: Robeco. September 2022. The value of your investments may fluctuate and estimated performance is no guarantee of future results.

Compared to last year, taking developed market equity market risk is somewhat less rewarded compared to fixed income risks. This is the first time since we first published the Expected Returns twelve years ago that we project that the developed equity risk premium for a euro investor will be below its steady-state excess return. This is partly because we envisage a level shift in consumption volatility that warrants a higher medium-term equity risk premium than is currently reflected by the market. Yet, from a nominal absolute return perspective, there is still hardly an alternative in the traditional multi-asset universe to equities, with only commodities on a par with equity returns for a euro investor.

Maintaining real purchasing power for a globally diversified portfolio will be daunting as we find that a globally diversified portfolio of stocks and bonds has a real, i.e. inflation-adjusted, return of -2.9% per annum when annual inflation is above 4%. In other words, inflationary periods are by far the worst when it comes to investors' purchasing power. With the exception of our bull case scenario, we see inflation in the 2.5% to 5% bracket for developed economies and this clearly also challenges portfolio diversification as the stock-bond correlation tends to be positive in this inflation range for developed markets. The quest for alternative assets to hedge equity risk will therefore continue. In this respect we note that we did not lower our real estate forecast while commodities are still expected to generate steady state-like returns despite the supercycle commodity returns posted over the last two years.

Bach's last B minor fugue from *Das Wohltemperierte Klavier* rocked the ruling paradigm of the eighteenth century musical world, inspiring Beethoven, Mendelssohn and many others in later centuries. Yet, Bach did not topple things as ultimately his compositions remained tonal in nature. Likewise, the age of confusion will challenge and transform the underpinnings of the Great Moderation we enjoyed in the past 40 years, but might not topple them yet. ●

EXPECTED RETURNS 2023-2027

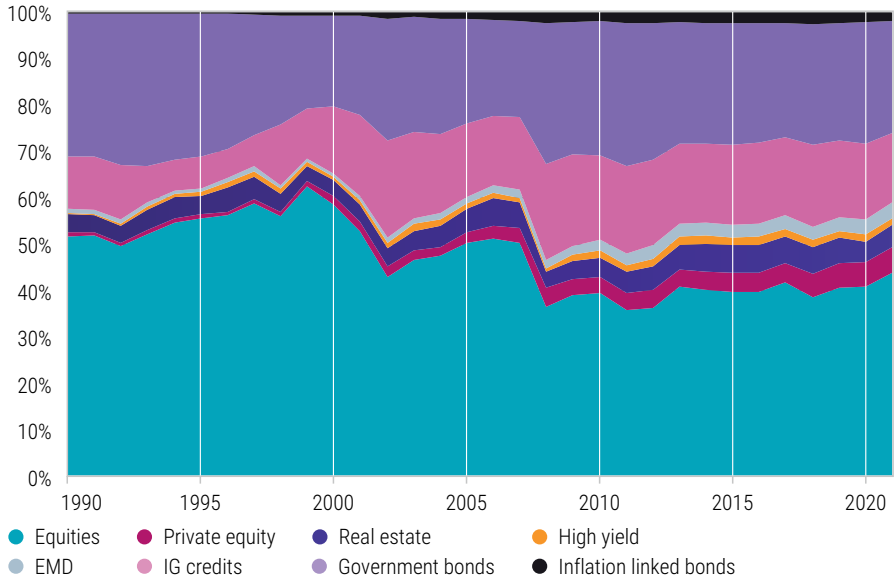
2. Valuation

Global investors saw the nominal value of their holdings fall by more than USD 25 trillion in the first half of 2022, wiping out over 15% of their portfolios. To some extent this is not surprising as our signals have been indicating that assets have been overvalued for years. It seems that the increase in inflation in the aftermath of the pandemic was one of the triggers for the repricing of many assets, but does the substantial drop in prices mean that financial assets have fallen to bargain levels?

In this chapter we set out our updated views on the valuation of each asset class. In the following chapters, we examine whether these valuations correspond with our long-term macroeconomic outlook.

The global multi-asset market portfolio is the natural starting point for every investor as it shows how the average invested dollar is allocated across asset classes. Figure 2.1 displays the weight of each asset class in the global market portfolio over the period from 1990 to 2021. At the end, listed and private equity accounted for a combined weight of 49.3%, slightly below the 52.0% average that Doeswijk, Lam and Swinkels (2014) observed over the 1959-2012 period, but slightly above the average over the past decade. There is no reason that the weights of the market portfolio should revert to their historical averages as future weights depend on the prices of existing assets and new issuance. Nevertheless, the chart suggests that the composition of the market portfolio has been rather stable since the global financial crisis.

Figure 2.1: Global multi-asset market portfolio between 1990 and the end of 2021



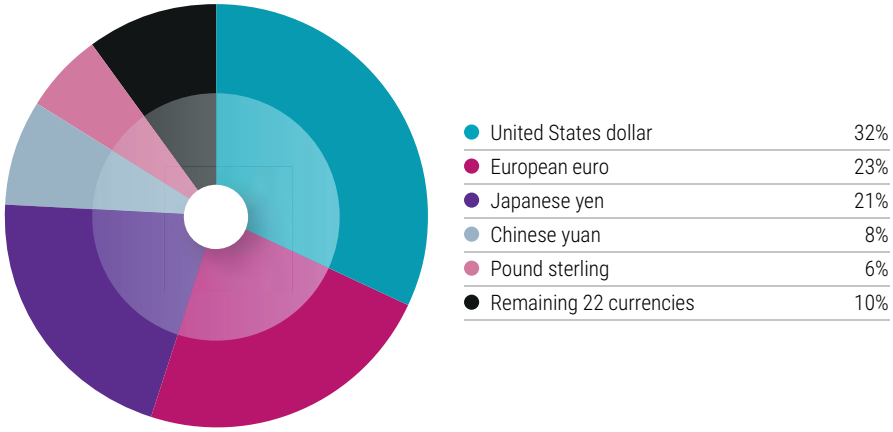
Source: Doeswijk, Lam, and Swinkels (2014) and updated from the Erasmus University Data Repository of Laurens Swinkels: https://doi.org/10.25397/eur.9371741. The figure shows market capitalization weights of each asset class at the end of every year from 1990 to 2021.

2.1 Government bonds

We assess the valuation of the major government bond markets according to three metrics: carry, the term premium and mean reversion.

Figure 2.2 shows the currency breakdown of investment grade government bond markets. It shows that the US, eurozone and Japan are the biggest markets, followed by China and the UK. Combined, these five regions account for 90% of the market, while the other 22 investment grade government bond markets account for just 10%.

Figure 2.2: Composition of the world's investment grade government bond markets

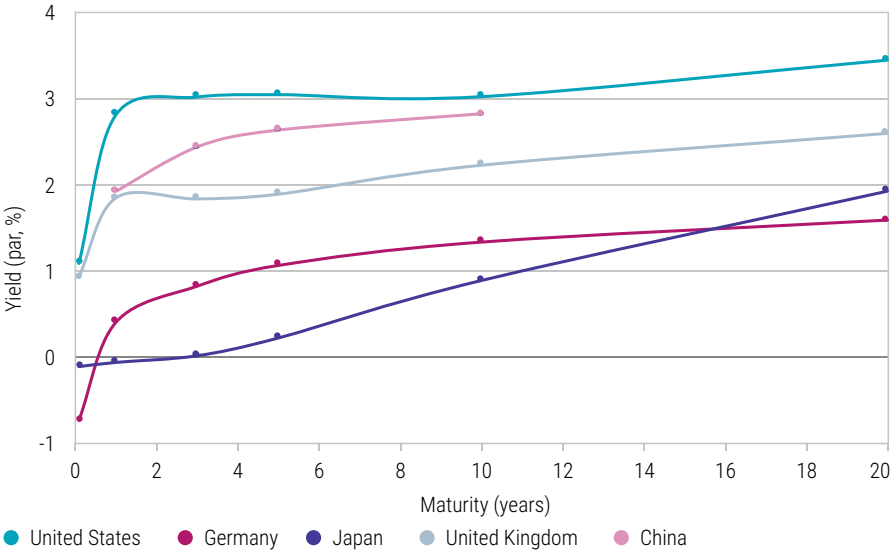


Source: Bloomberg, Barclays Live, Robeco. Composition of the Bloomberg Global Treasury Index on 30 June 2022.

2.1.1 Carry

Instead of trying to predict interest rates to determine the value of government bonds, we can start by determining the return they would provide should the interest rate curve remain unchanged. The return in this case is what we call the carry. Here, we ignore the second-order effect of the rolldown. Since our long-run estimate for the excess return of government bonds relative to bills is 0.75% per year, we view a carry substantially higher than this as attractive, and a lower carry as unattractive.

Figure 2.3: Par yield curves for the five main government bond markets



Source: Bloomberg, Robeco. As at 30 June 2022.

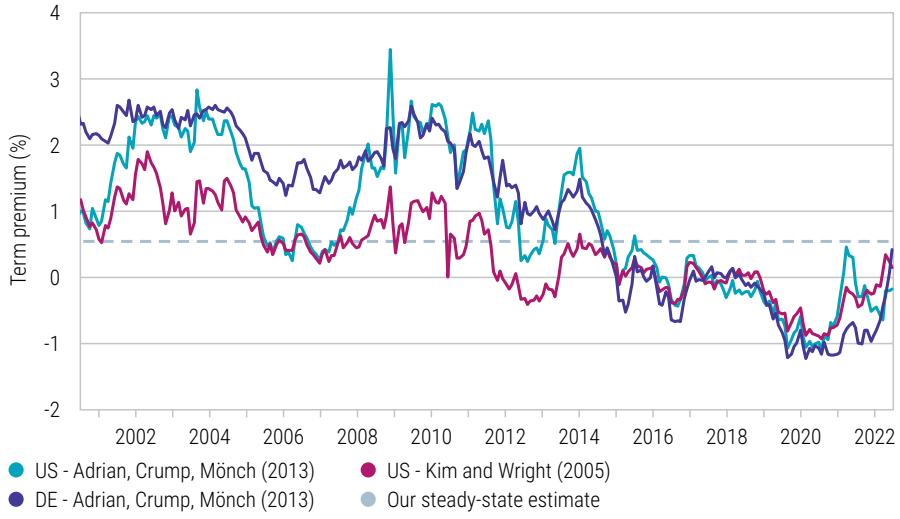
Figure 2.3 shows the shapes of the par yield curves of the five main government bond markets on 30 June 2022. The carry, sometimes referred to as the term spread, is often defined as the 10-year yield minus the one-year yield. There is a lot of discussion about whether a negative carry is indicative of a recession; see Harvey (1988). The US carry is only 0.21%, indicating that bond yields are relatively expensive. German yields are rather low but the carry is more attractive at 0.92%, similar to the 0.95% carry for Japan and the 0.89% for China. The carry for the UK is low at 0.38%.

2.1.2 Term premium

The term premium refers to the additional return an investor expects to receive from holding a government bond to maturity rather than rolling over bills until the same maturity. Since the expected path of short-term interest rates cannot be observed, the challenge is to come up with a good estimate. For example, if the expected yield earned by rolling over the bills until bond maturity is the current bill yield, the term premium would be equal to the carry we discussed above. Another option would be to use market-implied forward interest rates as the expected future short-term rates. This would by definition lead to a term premium of zero; that is, the expected return of bonds equals the expected return of bills. This would contrast with the term premium that has been observed since 1900.

Researchers have been making considerable effort to determine the expected path of the short-term interest rate. See, for example, Adrian, Crump and Mönch's (2013) model at the New York Federal Reserve Bank, and Kim and Wright's (2005) model maintained by the Board of Governors of the Federal Reserve System, which are compared in more detail by Adrian, Crump, Mills and Mönch (2014). Figure 2.4 shows the US 10-year term premium resulting from both models, which has been updated to 30 June 2022. Although the general movement in term premium estimates is similar, the level of the term spread can be very different for both models. For example, at the end of December 2009, the Adrian, Crump and Mönch model estimate was 2.70%, while for the Kim and Wright model it was 1.28%. The estimates have been similar overall since 2016, although during the past year there has been some divergence. The latest figures show estimates of -0.17% for the Adrian, Crump and Mönch model and 0.14% for the Kim and Wright model. These estimates are much higher than in 2020, when they stood at -1%, but both are still well below the 0.75% premium that we expect in the long run.

Figure 2.4: Term premium estimates for 10-year government bonds



Source: Bloomberg, Federal Reserve, Robeco. Updated data from Adrian, Crump, and Mönch (2013) is maintained online by the Federal Reserve Bank of New York, and from Kim and Wright (2005) by the Board of Governors of the Federal Reserve System. Data updated to 30 June 2022. For Germany we use our own estimates based on the model by Adrian, Crump, and Mönch (2013).

In Figure 2.4 we show the 10-year term premium, as this is what most economists consider. For the five-year term premium, which corresponds with the horizon of our outlook, the estimates of the term premium are close to the 10-year estimates, at -0.17% for the Adrian, Crump and Mönch model and 0.26% for the Kim and Wright model.

We are not aware of any external data providers that update these term premium models for other countries. Our own estimates, also displayed in Figure 2.4, indicate that the 10-year term premium for Germany according to the Adrian, Crump and Mönch model was 0.42% at the end of June 2022, while the five-year term premium was 0.26%. Our estimate for the Japanese term premium at the end of June 2022 is 0.15%. As is the case for the US, these figures represent substantial increases compared with what we have seen in recent years, but they are still well below the 0.75% steady-state estimate. We do not have term premium models for the other major markets.

A term premium of zero indicates that investors expect the same return from investing in bonds as in bills. This seems like a bad deal for investors, but there could be several possible reasons that such a situation could occur.

First, the investor base for bonds has changed over time. Central banks are now major players in government bond markets, and unlike typical bond investors, they aim to achieve their monetary goals rather than primarily seek a particular risk-adjusted return for their investment portfolio.

Second, regulation, due to which liabilities of pension funds and life insurance companies are marked to market, ensures that long-dated bonds provide the risk-free rate for these investors. Instead, these investors need to be compensated to take on risk – in other words, by buying short-dated bonds.

Third, as Campbell, Sunderam and Viceira (2017) argue, the correlation of bond returns with equity returns determines the existence of a term premium. A negative correlation implies that when equity markets fall, bond markets should rise in value. This type of insurance against adverse economic circumstances may be worth paying a premium for by all investors, even those who are price-sensitive. However, this last argument may not be as relevant today as the equity-bond correlation tends to increase in inflationary environments; see Molenaar and Swinkels (2022).

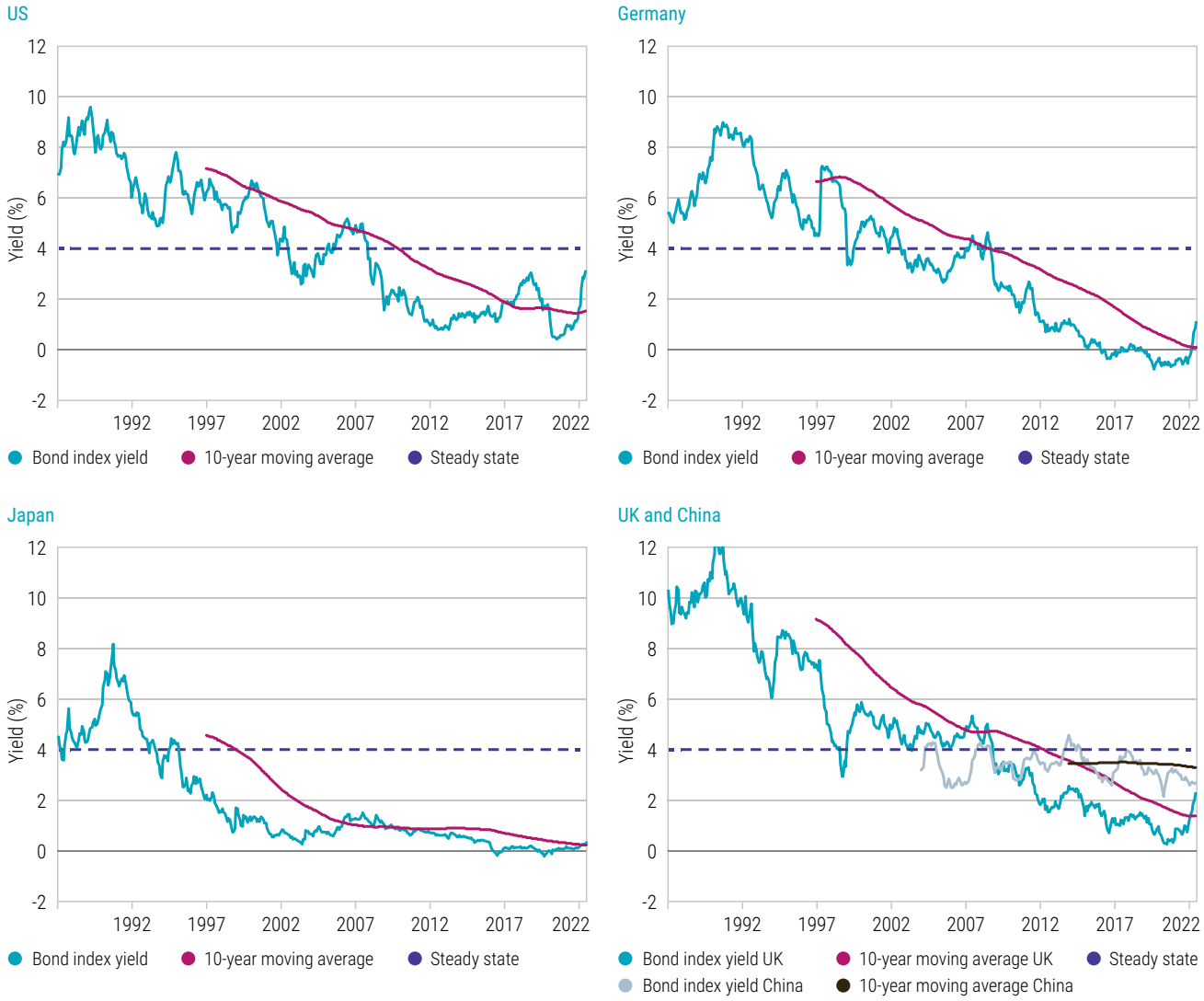
2.1.3 Mean reversion

Another popular way to look at valuation is to forecast a reversion to the mean. For example, Asness, Moskowitz and Pedersen (2013) use mean reversion as their main valuation signal. This is inspired by the excess returns documented by DeBondt and Thaler (1985) for equity strategies based on mean-reversion signals.

The challenge with mean-reversion signals is to determine the level the asset is supposed to revert to. To keep things simple, we compare the interest rate to its 10-year average rate. This is long enough for the average to cover business cycles, but short enough for it to adapt if there are persistent changes in the level of interest rates. An alternative would be to take the steady-state expected return of 4% as a starting point, but that would not account for persistent changes in the monetary environment that only revert in the very long term and not over the five-year horizon that is relevant to us.

Figure 2.5 shows the government bond index yields of the five main markets together with the 10-year moving average as the mean-reversion level. The figure shows that US, German and UK yields are above their 10-year moving average, suggesting that these bond markets are currently relatively cheap according to this measure. Japan's yield is very close to its 10-year average and China's a little below. All in all, we conclude that based on this metric, the recent interest rate increases have resulted in the mean-reversion signal flipping from expensive to cheap for the main bond markets.

Figure 2.5: Mean reversion of government bond yields



Source: Bloomberg, Robeco. The yield to maturity of the Bloomberg Treasury indices for the US, Germany, Japan, the UK and China, and their 10-year moving averages.

2.1.4 Summary

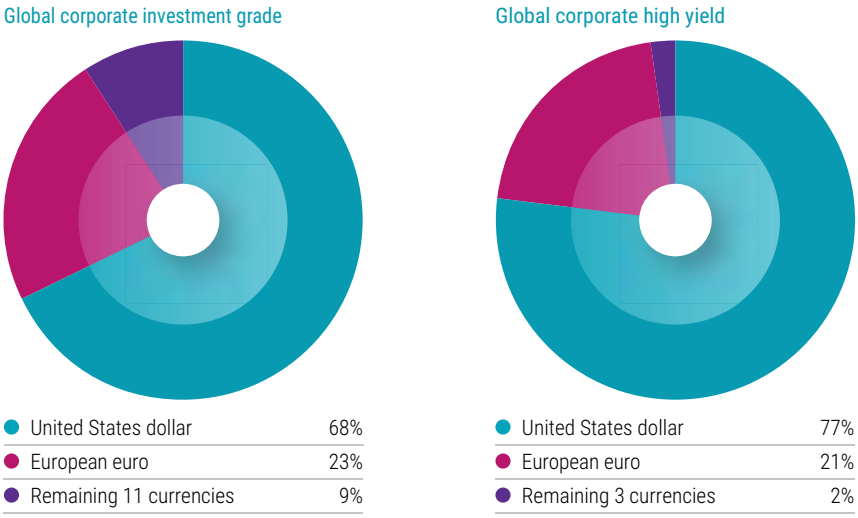
We have looked at three different ways to measure government bond valuations in the five main markets. Our conclusion is that overall, global government bonds have become substantially cheaper than they have been in recent years, but they are still expensive. Germany is slightly more expensive than the US. Yield levels and term premium estimates are still below their steady-state estimates.

2.2 Corporate bonds

The quality of bonds in the investment grade index has gradually fallen over time, especially for the euro-denominated market. Conversely, the credit quality of the high yield index has increased. Therefore, instead of considering the spreads of entire credit indices over time, we focus on the yields of bonds with specific ratings to judge whether corporate bonds are cheap or expensive. This keeps the credit quality constant – at least as judged by rating agencies.

Even though the companies issuing investment grade and high yield bonds are geographically quite diverse, the currencies in which they issue are limited. Corporate bond markets are dominated by US dollar issues, which account for 68% of the investment grade market and 77% of the high yield market. Euro issues come in second place, at 23% of the investment grade market and 21% for high yield, leaving very limited space for bonds issued in other currencies in the Bloomberg indices. Although many non-US companies issue bonds in US dollars, the indices are dominated by bonds issued by US firms, which account for 56% of the investment grade index and 62% of the high yield index.

Figure 2.6: Currency breakdown of investment grade and high yield corporate bond markets



Source: Bloomberg, Robeco, 30 June 2022.

Figure 2.7 shows that the credit spreads of investment grade (BBB) and high yield (B) corporate bonds have behaved similarly in recent years. They shot up because of the Covid lockdowns across the globe, but after central banks provided liquidity to the market, contracted quickly. More recently, spreads have increased substantially again. On 30 June 2022, USD BBB spreads were 190 bps and EUR BBB spreads 230 bps. This is substantially above the median spread of 160 bps, signaling that a recession may be around the corner. Meanwhile, USD B-rated bond spreads are at 640 bps, and they are at 800 bps for EUR B-rated bonds. The higher spreads in Europe may be due to the war in Ukraine and the energy challenges facing several European countries, and also because of the questions about the stability of the eurozone that are resurfacing due to increasing country spreads.

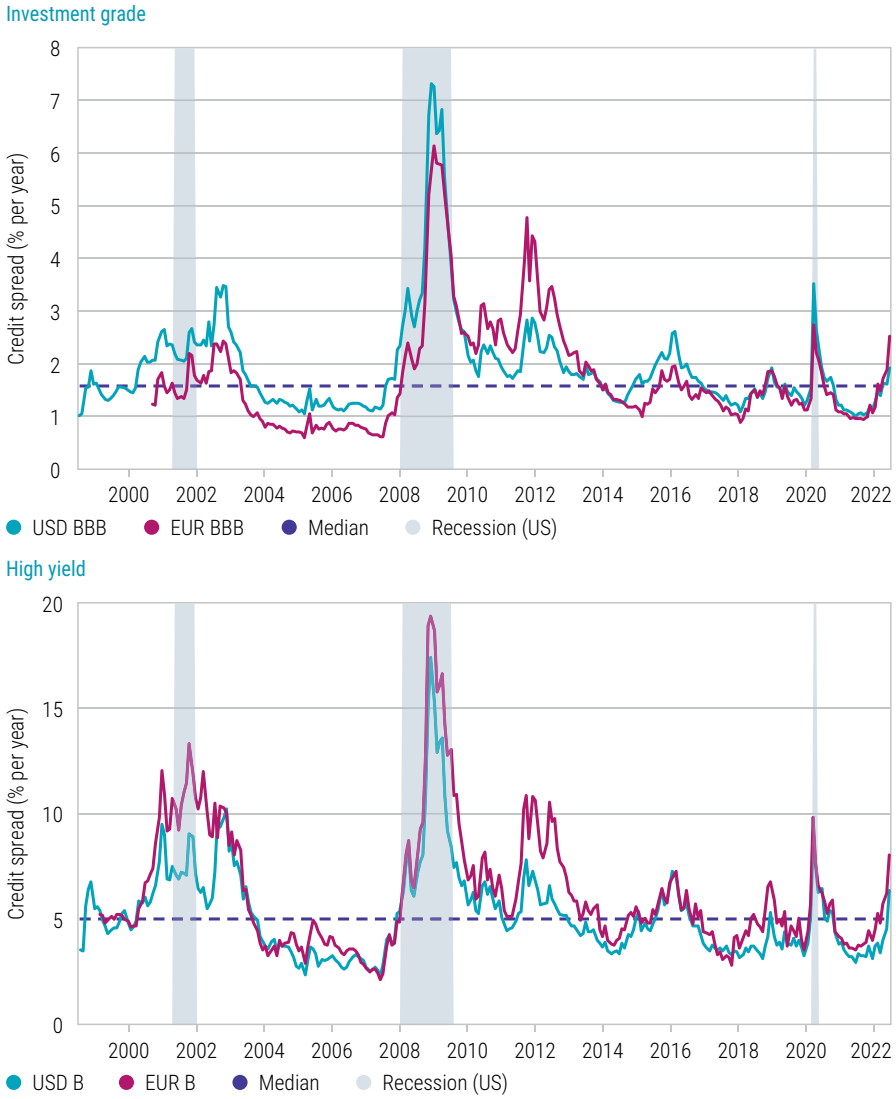
Although at the time of writing no recessions have been announced officially, many market participants are expecting a recession before the corporate bonds they are holding mature. The recession probability model of Chauvet (1998) for the US is currently still below 1%, but it is a real-time model used to indicate whether we are currently in a recession rather than predicting the probability of a recession within the next five years; see Chauvet and Piger (2008). However, now-casted quarter-to-quarter GDP growth for the third quarter of 2022 is negative for the US, eurozone, Japan and UK.[1] Recessions typically

1. Source: Macro Monitor 25 July 2022 from https://now-casting.com. For more on the methodology used, see Giannone, Reichlin, and Small (2008). Now-casting involves very near-term forecasts using the most recently available information.

result in increased default rates and lower recovery rates, leading to higher expected losses for investors. At this stage, credit spreads do not yet seem to be incorporating a full-blown recession. So while corporate bond spreads look cheap, they may not have fully priced in future economic conditions. As central banks' asset purchases may be more limited than they have been because of higher inflation, the next recession may lead to increased marked-to-market losses compared with recent recessions.

The global investment grade index's credit spread was 170 bps at the end of June 2022. Assuming that about half of the spread will be needed to cover losses due to default, the expected excess return is close to the neutral steady-state level of 0.75%. Meanwhile, the global high yield index's credit spread is 620 bps, which means it should be able to withstand considerable credit losses before reaching our neutral steady-state expected return of 1.75%. So from a valuation perspective, high yield corporate bonds seem a little cheap, while investment grade credit seems to be fairly valued.

Figure 2.7: Credit spreads of BBB- and B-rated corporate bonds

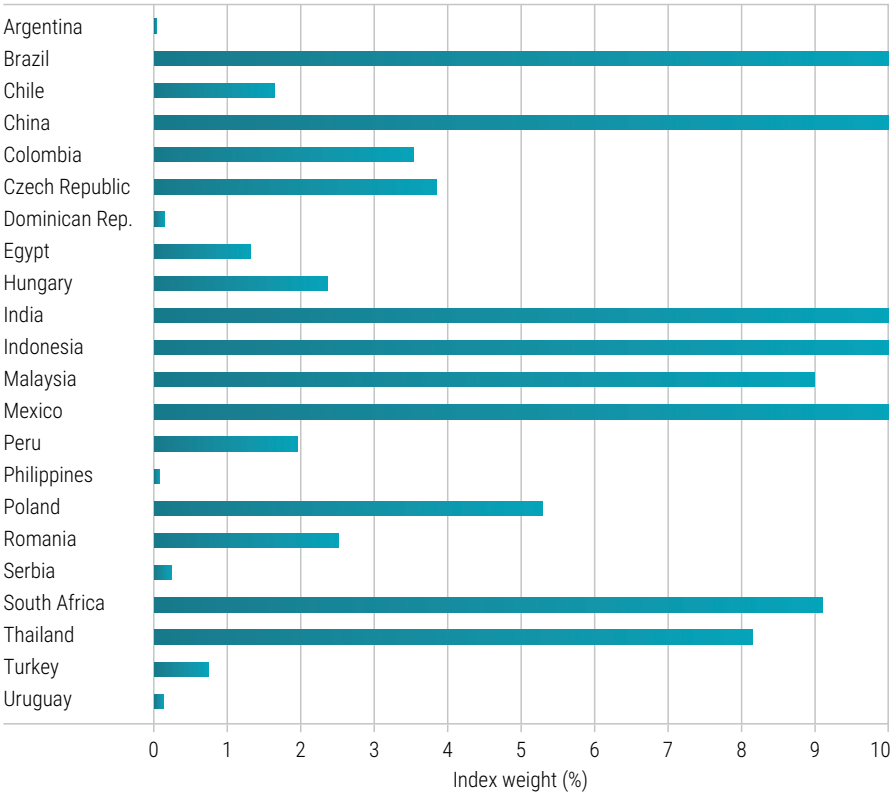


Source: Barclays Live, NBER, Robeco. The top figure shows the option-adjusted credit spreads of BBB-rated bonds in the Bloomberg Barclays US Corporate index and the Bloomberg Barclays Euro Corporate index. It also shows median credit spreads over the sample period. The bottom figure shows the option-adjusted credit spreads of B-rated bonds in the Bloomberg Barclays US High Yield index and the Bloomberg Barclays Euro High Yield index. It also shows median credit spreads over the sample period. Areas shaded grey indicate NBER contraction periods.

2.3 Local-currency emerging market debt

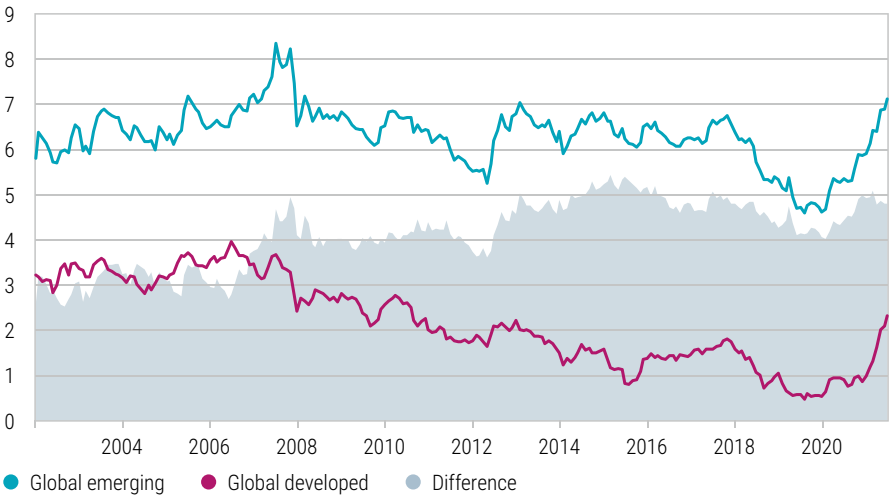
To assess the valuation of local-currency emerging market sovereign debt, we have opted to use the JP Morgan Government Bond Index-Emerging Markets (GBI-EM) Broad Diversified Index. The country breakdown of this index at the end of June 2022 is shown in Figure 2.8. The main constituents of the index are Brazil, China, India, Indonesia, Malaysia, Mexico, South Africa and Thailand. Each of these countries accounts for over 8% of the index, which limits individual country weights to 10% for diversification purposes.

Figure 2.8: Country weights in the local-currency bond market index



Source: JP Morgan, Robeco. Index weights of the JP Morgan GBI – Emerging Markets Broad Diversified Index as of 30 June 2022.

Figure 2.9: Yield to maturity of global developed and global emerging market bonds (%)



Source: JP Morgan, Robeco. Yield to maturity of the JP Morgan GBI – Emerging Markets Broad Diversified Index ('Global emerging') and the JP Morgan GBI – Global Index ('Global developed').

Figure 2.9 shows the yield to maturity of global developed and emerging debt markets, and we can see that the nominal yield of emerging markets has always been higher. Since 2003, emerging debt markets have yielded around 6% per year, with a short-lived spike above 8% during the global financial crisis. Emerging market yields then fell back towards 5%, but the 2013 taper tantrum saw rates jump back up to 7%. After dipping below 5% in 2020, emerging market yields have now risen above 7% again.

We can see from the chart that the difference in yield with developed markets has increased since 2003, mainly due to lower interest rates in developed markets and the addition of riskier countries to the local-currency government bond index. The nominal yield pick-up, or carry, provided by emerging market debt has increased from 4.4% to close to 5% over the past year.

Table 2.1: Differences in the real yields of local-currency emerging debt and developed government bonds

Yield	2015	2016	2017	2018	2019	2000	2021	2022
Emerging	6.81%	6.55%	6.26%	6.38%	5.33%	4.62%	5.91%	7.13%
Developed	1.58%	1.38%	1.46%	1.58%	1.06%	0.55%	0.99%	2.32%
Difference	5.23%	5.17%	4.81%	4.80%	4.27%	4.06%	4.91%	4.81%
Inflation								
Emerging	3.75%	3.50%	3.87%	3.00%	3.60%	2.29%	5.72%	6.04%
Developed	0.51%	1.54%	1.71%	1.65%	1.54%	0.61%	5.35%	4.37%
Difference	3.24%	1.97%	2.15%	1.35%	2.06%	1.68%	0.37%	1.67%
Real yield								
Emerging	3.06%	3.05%	2.40%	3.38%	1.73%	2.32%	0.19%	1.09%
Developed	1.07%	-0.16%	-0.26%	-0.08%	-0.48%	-0.06%	-4.36%	-2.06%
Difference	1.99%	3.21%	2.65%	3.46%	2.21%	2.39%	4.55%	3.14%

Source: IMF, JP Morgan, Robeco. The 2022 column shows yields from 30 June 2022. End-of-year inflation is from the IMF World Economic Outlook (April 2022). The country-level inflation rates are combined using JP Morgan Global Bond index weights at 30 June 2022.

Table 2.1 provides an indication of the attractiveness of local-currency emerging market debt from a yield perspective compared with developed market debt. We subtract inflation from the yields to obtain real yields for both regions. The difference in real yields is 314 bps at the end of June 2022 – substantially below the level at the end of 2021, when the real yield difference was 455 bps, but close to the average between 2015 and 2021.

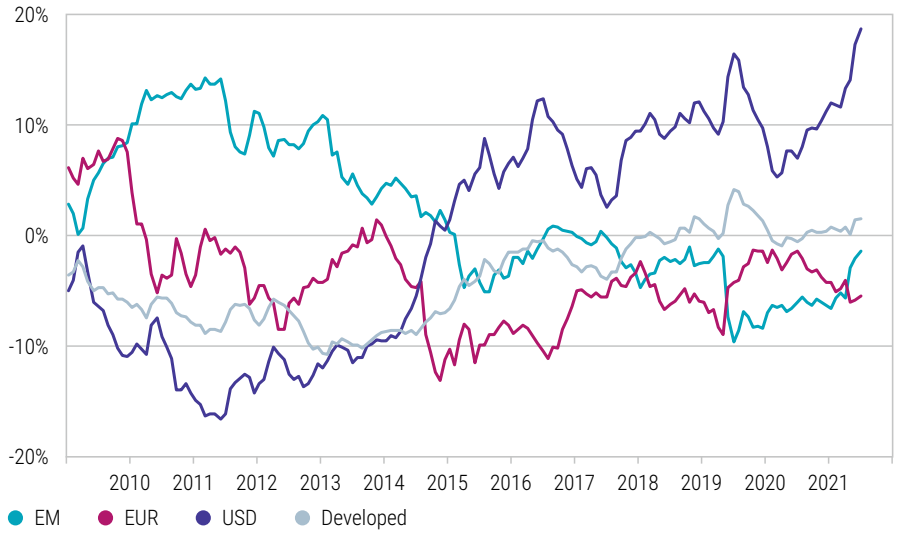
The difference in real yields may partially represent compensation for credit risk, even though there is virtually no credit risk on nominal debt issued by sovereigns that can print their own currency to pay off debt. However, such money printing would be expected to lead to inflation and currency devaluations. This means that credit risk should be viewed as a currency risk from the perspective of an investor from the US or Europe. Overall, yields are fairly valued, in our view.

2.3.1 Currencies

To consider the overall valuation of emerging debt, we need to consider currency valuations as well. To do so, we use Bank for International Settlements (BIS) real effective exchange rates (REERs) for the emerging market bond index based on its composition at the end of June 2022. We subtract its 15-year average from each of the REERs as we assume that such a long-term average is a good representation of its fair value.

In Figure 2.10, we compare these emerging market REERs with those of a basket of developed currencies and the US dollar and euro. From 2009 to 2014, emerging market currencies were overvalued, while the latest levels show that these currencies are less than 5% undervalued compared with a basket of developed market currencies. Emerging market currencies are 20% undervalued relative to the US dollar, which is itself considerably overvalued according to this metric. Emerging currencies are 5% overvalued relative to the euro, suggesting that the euro is cheap.

Figure 2.10: Currency valuations using real effective exchange rates



Source: BIS, Robeco. The BIS real (CPI-based) effective exchange rates as of 30 June 2022 are compared with their 15-year historical averages. The lines for emerging markets and developed markets are combined based on individual currencies' index weights in the JP Morgan Global Bond indices on 30 June 2022. Note that for the Dominican Republic, Serbia and Uruguay the BIS does not report REERs, so we have assumed all three are fairly valued. These countries combined account for less than 0.5% of the index.

2.3.2 Summary

We conclude that emerging market bond yields and currencies are fairly valued relative to a basket of developed market bond yields. This leads to a neutral valuation signal for local-currency emerging debt. However, when judged relative to government bonds from the US and eurozone, the asset class looks more attractively valued. For a US dollar investor, the currency component seems attractive assuming that half of the 20% overvaluation will revert, while bond yields are fairly valued, with a differential of about 5%. For a eurozone investor the attractiveness is mainly due to the interest rate differential of 7%, whereas the euro's slight undervaluation is likely to detract from the expected return of local-currency emerging debt.

2.4 Developed market equities

There is evidence that the equity premium can be predicted, even though much of the variation in actual returns typically remains unexplained. One of the predictors that stands out is Campbell and Shiller's (1998) cyclically adjusted price-earnings (CAPE) ratio; see, for example, Ilmanen et al. (2021). This is the main indicator we discuss here in addition to Tobin's Q and the Buffett indicator.

These are measures of equities' absolute valuations and do not necessarily indicate how expensive stocks are relative to bonds. This might be important, because – all else being equal – lower bond yields result in higher equity prices due to there being a lower discount rate for future cash flows.

2.4.1 CAPE ratio

The CAPE ratio is a valuation measure that uses real earnings per share (EPS) over a 10-year period to smooth out fluctuations in corporate profits that occur over different periods of a business cycle. Jivraj and Shiller (2017) show that the CAPE's out-of-sample performance is strong compared with many of its competitor valuation signals. Table 2.2 contains the CAPEs for the largest developed equity markets. For most countries, the data history for the CAPE starts in December 1981, which means we have four decades of international data. As structural differences between countries might lead to different CAPEs, we compare each country with its own valuation history.

Table 2.2: Cyclically adjusted price-earnings ratios for developed countries

Country	Start	Median	Current	Valuation	Weight
Australia	Dec-81	20.2	20.5	≈	2.2%
Canada	Dec-81	22.5	21.5	≈	3.6%
France	Feb-99	23.3	23.0	≈	3.1%
Germany	Dec-81	20.5	16.7	↓	2.2%
Hong Kong	Dec-81	20.1	16.6	↓	0.9%
Italy	Apr-93	21.3	19.1	↓	0.6%
Japan	Dec-81	37.3	20.2	↓	6.2%
Netherlands	Dec-81	17.3	28.0	↑	1.1%
Singapore	Dec-81	21.3	13.1	↓	0.4%
Spain	Jan-89	16.6	14.7	↓	0.7%
Sweden	Dec-81	22.9	18.7	↓	0.9%
Switzerland	Dec-81	23.7	25.4	↑	2.9%
UK	Dec-81	17.1	16.7	≈	4.4%
USA	Dec-81	23.8	28.5	↑	68.7%
World		**23.4**	**25.5**	↑	
Europe		**19.2**	**19.7**	≈	

Source: Barclays Research, MSCI, DataStream, Robeco. The CAPE ratio for each country has been calculated by Barclays Research using the levels of country-specific indices published by MSCI representing the equity markets for the relevant country, adjusted for inflation using data from DataStream. The 'Start' column indicates the start of the sample period, and the 'Median' column the monthly time-series median of the CAPE ratio from the start of the sample to June 2022. The arrows in the 'Valuation' column indicate whether the current CAPE ratio is above (red arrow up, indicating expensive), close to (black approximately equal sign) or below (blue arrow down, indicating cheap) the median. The last column, 'Weight', is the weight of the country in the MSCI World index at the end of June 2022. The row for Europe uses data from Barclays Research, but the row for World is a weighted average (using the weights in the final column) of each of the individual country figures.

Because of the sharp equity market fall in the first half of 2022, the CAPEs for many countries have returned to, or declined below, their historical medians. There are three exceptions: the Netherlands, Switzerland and the US. The Netherlands only accounts for a small weight in the global developed equity index, but the US is by far the largest. Due to the effect of the US, the global developed stock market index still looks somewhat expensive with a CAPE of 25.5, above its historical median of 23.4. But we need to bear in mind that last year the CAPE was 34.2, so the market is now much less overvalued.

Bunn and Shiller (2014) show that when companies buy back shares, the original CAPE might be somewhat biased because the growth rate in EPS is affected, leading Shiller's data page to include a 'total return CAPE' to adjust for this bias. While the traditional CAPE for the US was 28.5 at the end of June 2022, the total return CAPE stood at 31.4. While the current difference of 2.9 is a little lower than the historical difference between the two, both versions of the CAPE signal that US equity markets are expensive.

2.4.2 Tobin's Q

Tobin's Q is the market value of equities divided by their net worth measured at replacement cost, which is typically a better fair-value metric than the historical cost, especially in times of high inflation. The natural 'fair value' of Tobin's Q is 1, in which case the stock market would be paying exactly the same as the cost of replacing assets, and an investor should be indifferent to buying the shares or setting up the same company from scratch.

However, it turns out that historically, the average figure has been in the range of 0.6-0.7. Estimates of Tobin's Q for the US from 1900 to 2002 are reported in Wright (2004) and are available from the archive of his website.[2] Figure 2.11 shows that Tobin's Q is currently 1.5, substantially above both its historical average and its theoretical value of 1.0, indicating that the US stock market is expensive. But this is probably because data about replacement costs for the second quarter has not yet been released. It is expected that Tobin's Q will be about 15% lower if replacement costs have remained relatively constant over the quarter as equity markets have fallen by about 15%. But even after such a drop, Tobin's Q would still be substantially above one.

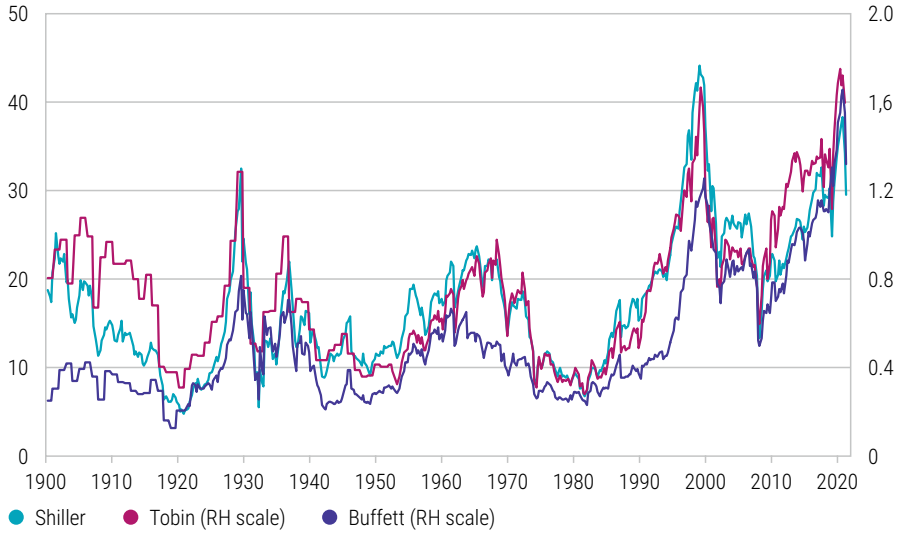
2. https://web.archive.org/web/20151028070108/http://www.bbk.ac.uk/ems/faculty/wright/pdf/Wright2004dataset.xls

2.4.3 Buffett indicator

Warren Buffett popularized the market value of equities relative to the nominal GDP of a country as a measure of overvaluation or undervaluation. Lleo and Ziemba (2019) find that using this ratio in market timing can generate additional returns, mainly through predicting crashes rather than equity market rallies. Umlauft (2020) and Swinkels and Umlauft (2022) report on the long-term predictive powers of the Buffett indicator for the US and international markets, respectively. Figure 2.11 shows that the Buffett indicator has come down from 1.6 a year ago to 1.3. This is still well above its historical average, suggesting that the US market remains overvalued.

An international comparison for this figure is challenging as it is affected by the percentage of companies that are publicly traded compared with those that are private, and whether a country is attractive to list in for multinational corporations. The ratio may also be more affected by new equity issuance than by valuation changes, even for an individual country across time.

Figure 2.11: Tobin's Q, Shiller CAPE and Buffett indicator for the US equity market

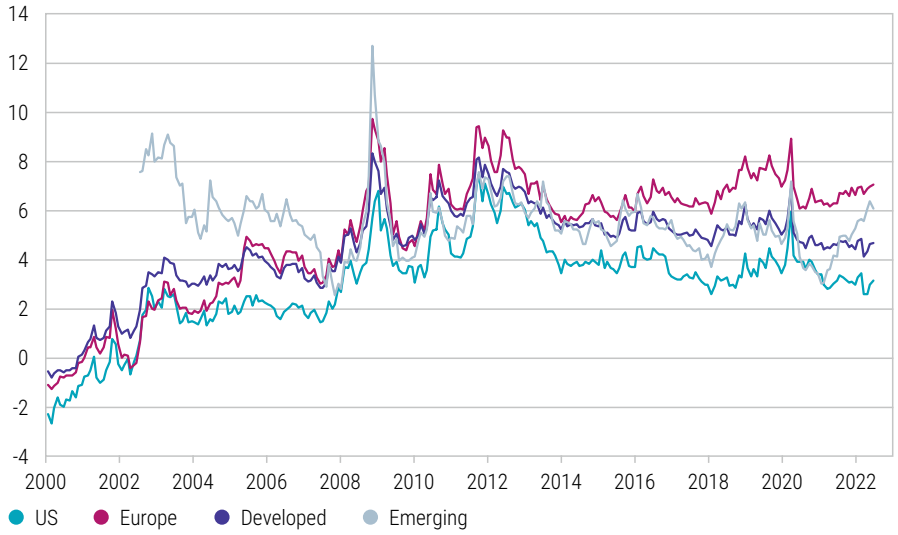


Source: Refinitiv, Federal Reserve, Robeco. The Tobin's Q is calculated using data from the Fed and from Wright (2004) before 1951. The Buffett indicator is the market value of S&P 500 companies divided by the GDP of the US. Before 1964, we use the market value of the NYSE divided by US GDP.

2.4.4 Implied equity risk premium

An obvious explanation for increased equity market valuations is low interest rates. One way to put absolute valuations into perspective is to examine the equity risk premiums that are priced in by the market. Damodaran (2020) explains that there are several methods to determine the implied equity risk premium from observable data. Here we obtain the implied equity risk premium by dividing expected earnings by the price and subtracting the government bond yield. This method is also known as the Fed model. The implied equity premium for the US is currently relatively low at just over 3%, especially compared with its level of almost 7% in Europe. On the one hand, current implied US equity premiums show that even though valuations are high, expected returns for equity investors can be above those of bond investors at a time of low risk-free rates. On the other hand, it also shows that the implied equity risk premium does not increase when stock markets are falling sharply and interest rates are increasing at the same time, as the implied equity premium in the US is virtually the same as a year ago. For developed markets as a whole, the implied equity premium stands at about 4.5%, which is also about the same as a year ago.

Figure 2.12: Implied equity risk premiums



Source: Refinitiv Datastream, I/B/E/S, Robeco. Forward earnings (12 months) to price minus the government bond yield. For emerging markets, Chinese government bond yields are used as a proxy.

Recently, Shiller introduced the 'excess CAPE yield', which is the inverse of the Shiller CAPE adjusted for long-term real interest rates. It serves as a proxy for the expected risk premium on equities. For more information about its predictive power for US equity markets, see Catanho and Saville (2022). Even though the model underlying the implied equity premium in Figure 2.12 and the excess CAPE yield are somewhat different, both methods currently predict an implied risk premium for US equities of exactly 3.1%.

2.4.5 Summary

Most developed equity markets are currently neutrally or cheaply valued, but the US is an outlier as it is expensive, albeit arguably less so than a year ago. As the US accounts for roughly two-thirds of developed world market capitalization, developed equity markets overall are still expensive.

2.5 Emerging market equities

The CAPE ratio for emerging market stocks has historically provided useful information about valuations in emerging markets; see Klement (2012).

Although the figures for developed and emerging markets are not entirely comparable because CAPE data for emerging markets starts substantially later than for developed markets, Table 2.3 shows that the weighted average CAPE for emerging equities is 18.5, lower than the 23.4 of developed markets.

There are several possible explanations for this. First, the higher systematic risk in emerging markets is reflected in higher discount rates, leading to lower prices for the same expected earnings. Second, emerging markets may not be fully financially integrated with the rest of the world, and this market segmentation leads to higher discount rates. Third, emerging equity markets may be tilted towards industries with lower growth potential and therefore lower valuations than developed markets. Therefore, for valuation purposes, it may be more relevant to compare each country to its own historic CAPE levels than comparing CAPEs across countries.

The CAPEs of all countries except India are below their historical median levels, and the CAPE ratios for Poland and Turkey are in fact in single digits. The weighted average CAPE across all emerging markets is 17.2, slightly below its historical median of 18.5.

So based on this measure, emerging markets seem slightly cheap overall compared with their own historical levels. And compared with developed markets' CAPE of 25.5, emerging market equities seem even more attractively valued.

Note that Russia is not in Table 2.3 as the Russian market is no longer accessible to foreign investors due to sanctions. In last year's report, it was one of the most attractively valued markets within the emerging universe. This is a good warning that cheap assets may be cheap for a reason.

Table 2.3: Cyclically adjusted price-earnings ratio for emerging countries

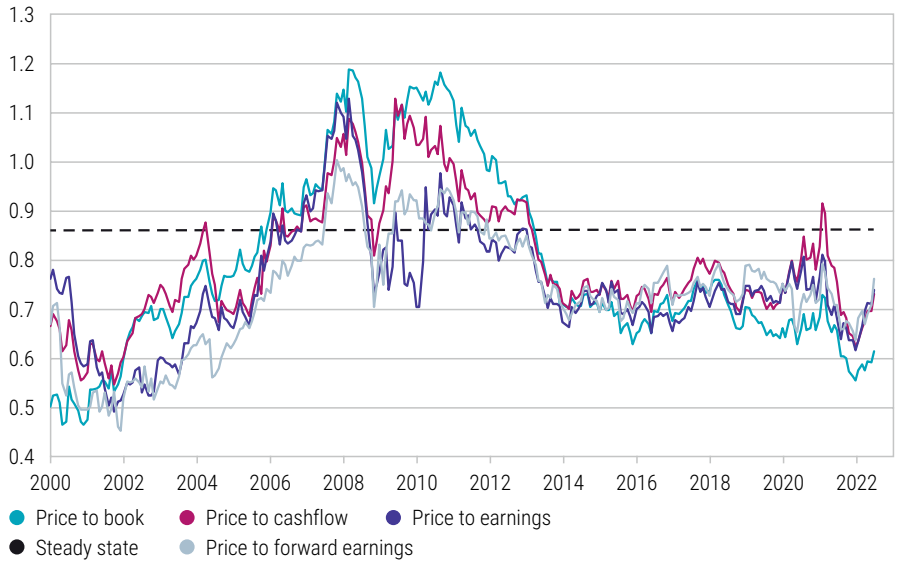
Country	Start	Median	Current	Valuation	Weight
Brazil	May-11	13.9	13.0	≈	5.6%
China	Oct-04	16.6	13.5	↓	40.8%
India	Aug-03	22.8	28.2	↑	14.6%
Israel	Sep-04	17.9	14.6	↓	1.8%
Korea	Sep-04	15.2	12.4	↓	13.0%
Mexico	Jan-01	23.5	18.7	↓	2.4%
Poland	May-04	13.4	8.4	↓	0.7%
South Africa	Aug-04	20.6	16.8	↓	4.1%
Taiwan	Jul-04	22.8	22.7	≈	16.7%
Turkey	Jan-01	12.3	7.3	↓	0.3%
Emerging		**18.5**	**17.2**	↓	

Source: Barclays Research, MSCI, DataStream, Robeco. The CAPE ratio for each country has been calculated by Barclays Research using levels of country-specific indices published by MSCI representing the equity markets for the relevant country, adjusted for inflation using data from DataStream. The 'Start' column indicates the start of the sample period, and the 'Median' column the monthly time-series median of the CAPE ratio from the start of the sample to June 2022. The arrows in the 'Valuation' column indicate whether the current CAPE ratio is above (red arrow up, indicating expensive), close to (black approximately equal sign) or below (blue arrow down, indicating cheap) the median. The last column, 'Weight', is the weight of the country in the MSCI Emerging Markets Index at the end of June 2022. The Emerging row uses a weighted average (based on the weights in the final column) of each of the individual country figures.

2.5.1 Other relative valuation measures

Figure 2.12 includes the implied equity premium for emerging markets. It has increased from 4.1% to 6.0% over the past year. This suggests that emerging market equities have become more attractively valued. To further test the robustness of the CAPE, we also look at other bottom-up measures of value: price-to-book, price-to-cashflow, price-to-earnings and price-to-forward earnings ratios. Figure 2.13 shows that since 2014, valuations of emerging markets have been consistently below those of developed markets, trading at a discount of 20-30%. Just like with the CAPE, we expect the ratios to be below unity on average. A long-term discount can be estimated by assuming the long-term cost-of-capital for emerging markets equities to be 0.5% higher than for developed markets. Under strong assumptions, this leads to a relative valuation discount of 14% over the long run. Compared to this, emerging equities' current discount of around 30% relative to developed equities appears high.

Figure 2.13: Emerging equity valuations relative to global equity valuations



Source: Refinitiv Datastream, MSCI, Robeco. Each month we divide the bottom-up-calculated valuation ratio of the MSCI Emerging Markets Index by the same valuation ratio for the MSCI World Index. The latter only contains developed markets.

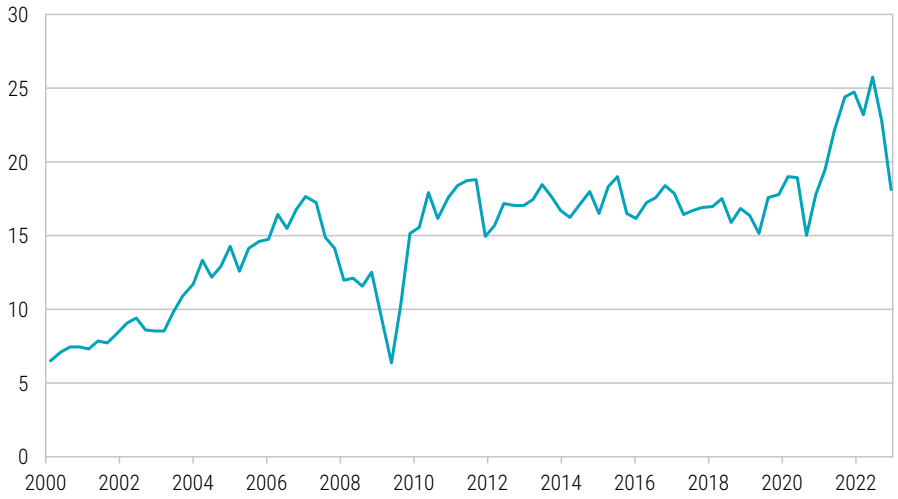
2.5.2 Summary

Compared with both their own history and developed markets, emerging equities look attractively valued at present.

2.6 Listed real estate

We compare listed real estate valuations with those of global equities. Although the price-earnings ratio is admittedly not the ideal measure for assessing valuations of real estate investment trusts, it is one of the best available. The CAPE ratio of global real estate is currently 14.5, well below its average of 19.9 since 2000. The CAPE of global equities is about 10 points higher at 25.5, making real estate look relatively cheap according to this measure.

Figure 2.14: REIT-specific valuation ratio for US REITs



Source: S&P Global Market Intelligence, Nareit T-Tracker, Robeco. The valuation ratio specific to US Real Estate Investment Trusts is the price (P) divided by the funds from operation (FFO).

A valuation measure commonly applied to real estate investment trusts involves comparing their price with their funds from operation (FFO). The FFO is calculated as net income plus depreciation and amortization minus gains on sales of properties. In the US, the price-to-FFO is reported at the market level. See Seok, Cho, and Ryu (2020) for more information about the reaction of US REIT prices to FFO announcements. They conclude that the market reacts more to FFO announcements than to other announcements, such as net income.

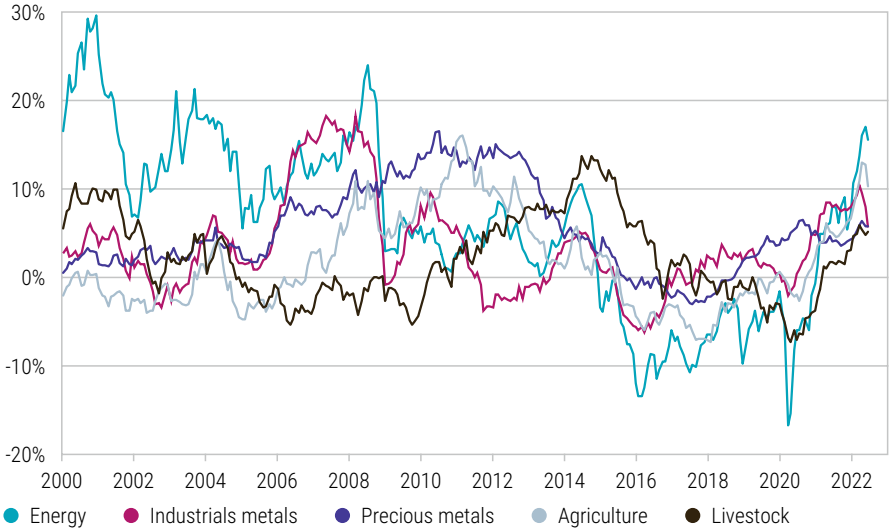
Figure 2.14 shows this valuation ratio up to the second quarter of 2022. In the first quarter this measure fell from its record high of 25.8 at the end of 2021 to 22.7. It continued to fall in the second quarter to a level of 18.2. This is above its historical median of 16.4. It is difficult to determine what a 'normal' ratio is given that this measure has only been available for a short time – since 2000. If we consider this limited data series, it appears that according to this measure, real estate is expensively valued compared with its past levels.

Based on real estate's relatively low CAPE, suggesting that it is cheap, and its elevated price-to-FFO ratio, suggesting it is expensive, we assess real estate to be neutrally valued.

2.7 Commodities

We use the definition of commodity valuation presented by Asness, Moskowitz and Pedersen (2013). This involves comparing the current spot price with the average spot price from 4.5-5.5 years ago. The idea is to use the price from five years ago, but averaging ensures that temporary outliers do not affect the valuation signal too much. Instead of calculating the valuation of each traded commodity separately, we consider the five main commodity categories: energy, industrial metals, precious metals, agriculture, and livestock. If the commodity price is the same as five years ago, the signal would stand at 0% and suggest neutral valuation. A number above zero means that the price is higher than five years ago and indicates that the commodity group is expensive.

Figure 2.15: Valuation signal for commodities



Source: Refinitiv Datastream, S&P GSCI, Robeco. The figure shows the natural logarithm of the commodity category price index divided by the natural logarithm of the average of the same price index from 5.5 to 4.5 years ago, minus one. Monthly data in US dollars.

Figure 2.15 shows that energy commodities were in general overvalued from 2000 to 2014, as their price had increased relative to five years previously. In 2015 and 2020, however, they were more than 10% undervalued. They have recovered since the Covid crisis, like most other commodities, such that they were around 16% overvalued by the end of June 2022. Agriculture is 10% overvalued, and the other commodity categories around 5% overvalued.

Typical commodity indices have the highest exposures to energy, followed by agriculture. Therefore, we deem commodities to be expensive overall at present.

2.8 Currencies

We briefly referred to currency valuations in the section comparing local currency government bonds from developed and emerging countries. We saw that the US dollar is very expensive, whereas the euro is even cheaper than a basket of emerging market currencies.

Table 2.4: Valuation signals for developed currencies

	Effective Exchange Rate			Big Mac index		Interest rate
Country	Rel REER	REER	NEER	Raw	GDP-adjust	5-year
Australia	-23.2	-38.3	-38.9	-10.2	-8.7	4.1
Canada	-24.0	-42.5	-39.5	2.0	10.2	3.6
Euro area	-24.2	-35.7	-23.6	-7.5	4.2	1.0
Japan	-47.2	-68.5	-54.1	-45.1	-42.4	0.3
New Zealand	-18.5	-23.8	-23.0	-14.0	-7.1	3.9
Norway	-31.4	-48.3	-49.6	21.6	24.3	3.2
Sweden	-30.6	-42.6	-35.1	8.5	18.8	2.7
Switzerland	-18.4	-23.8	6.9	30.3	31.0	1.3
United Kingdom	-20.8	-25.8	-27.2	-13.8	-6.1	2.8
United States	0.0	0.0	0.0	0.0	0.0	3.0

Source: BIS, The Economist, Barclays, Robeco. The first column, 'Rel REER', contains the Real Effective Exchange Rate (REER) relative to its 15-year history. The second and third columns contain raw data about the Real and Nominal Effective Exchange Rates (REER and NEER), as of 30 June 2022. The next two columns show the raw difference in the price of a Big Mac compared with one in the US and a GDP-adjusted price difference, updated in June 2022. The last column shows the five-year zero-coupon government bond yield of each country on 30 July 2022.

The first column in Table 2.4 contains the relative REER that we used in the previous section, but here it has been normalized such that the US dollar is at zero, enabling it to be easily compared with other measures. The absolute REER and the nominal effective exchange rate (NEER), which is not adjusted for inflation differentials, are in the adjacent columns. The US dollar is currently substantially overvalued according to all measures reported by the BIS, and by more than 20% relative to most other currencies.

We have also included the Economist's Big Mac index, which should provide a figure that is comparable to the REER. Since this index shows the relative price of one particular item – a Big Mac – across currencies, it can be interpreted as a relative valuation of currencies based on one item rather than a basket of items or standard exchange rates. By contrast, the REER considers a basket of consumption goods and services. This can lead to large differences in currency valuations.

The column labeled 'Raw' in Table 2.4 shows price differences of the Big Mac index versus the price in the US, while the GDP-adjusted figure corrects this raw number for GDP per capita. This adjustment is necessary as countries with higher productivity tend to have higher prices of non-tradable goods and services (see Balassa 1964 and Samuelson 1964). Based on the Big Mac index, the US dollar is less overvalued than it is based on REER and NEER. The Big Mac index makes the Swiss franc and Norwegian krone seem substantially overvalued compared with the US dollar. The Australian and New Zealand dollars, the Japanese yen and the UK pound are all cheap according to each currency valuation measure, with the Japanese yen looking extraordinarily cheap.

When we consider the relative strength or weakness of individual currencies, we might be tempted to hedge currencies that are overvalued and are therefore predicted to weaken.

However, currency hedging comes at a cost, which is equivalent to the difference in interest rates between the foreign country and the investor's home country. Here, we use the difference in five-year zero-coupon government bond yields between the foreign country and the investor's home country as a proxy for currency hedging costs.

A European investor with savings worth USD 100 in their US bank account, on which they earn 3% interest, is exposed to changes in the USD/EUR exchange rate if they want to convert their savings back into the euro after a year. If they want to eradicate this currency risk, they can either buy a currency future or convert the USD 100 to around EUR 100 today and receive the 1% European interest rate on their bank account instead. The return on their savings, which was 3% in US dollars, falls to 1% in euros. This is the way currency forward contracts work. As such, the cost of hedging currency risks is approximately equal to the difference in interest rates between the two countries.

Since this outlook has a five-year horizon, we also include five-year bond yields in the last column. A eurozone investor might choose to hedge their US dollar currency risk because they see that, based on the relative REER in the first column, the US dollar is 24% overvalued relative to the euro. They would see that the cost of doing so is just over 2% per year over the next five years as the US interest rate is 3% and that of the eurozone 1%. If after five years the dollar's overvaluation has completely disappeared, the investor would have gained 24% thanks to the US dollar's depreciation and lost 10% on the interest rate differential, resulting in a 14% total gain. If half the currency overvaluation disappears, the currency hedger's profit is only 2%, with a gain of 12% on the currency nearly offset by the loss of 10% on the interest rate. The early literature (Rogoff 1996; Frankel and Rose 1996) found that, on average, half the REER gap closed in about five years for developed currencies. More recent estimates by Rabe and Waddle (2020) find that half of the convergence occurs within three years. ●

EXPECTED RETURNS 2023-2027

3. Climate

Investors across the world are making pledges to decarbonize their portfolios in order to facilitate the energy transition and combat climate change.
A recent survey[1] indicates that 27% of global investors have made public pledges for net-zero portfolios in or before 2050. As part of this, institutional investors plan to divest 19% of their portfolios because they are too carbon intensive, mostly in the asset classes equities and corporate bonds.

1. https://www.robeco.com/en/media/press-releases/2022/robecos-climate-survey-shows-continued-momentum-on-climate-change.html

3.1 Introduction

The reason that climate change is so important to investors is because of the negative effects it already has on the daily lives of millions of people around the world. In the latest IPCC report[2], researchers from across the world show that human-induced climate change, including more frequent and intense extreme weather events, has caused adverse impacts and related damage to nature and people, beyond natural climate variability. The rise in weather and climate extremes has led to some irreversible impacts as natural systems are pushed beyond their ability to adapt.

2. https://www.ipcc.ch/report/ar6/wg2/

Figure 3.1 shows that food and water security have been negatively affected, impeding efforts to meet the UN's Sustainable Development Goals. Ocean warming and ocean acidification have reduced food production. Sudden losses of food production and access to food compounded by decreased diet diversity have increased malnutrition in many low-income communities. Climate change has also negatively influenced the physical and mental health of people globally. Hot extremes including heatwaves have intensified in cities, where they have also aggravated air pollution events and limited functioning of key infrastructure. This has created a sense of urgency among investors to reduce climate change by lowering global carbon emissions.

Figure 3.1: Observed impacts of climate change on human systems

	Impacts on water scarcity and food production				Impacts on health and wellbeing				Impacts on cities, settlements and infrastructure			
Human systems	Water scarcity	Agriculture/ crop production	Animal and livestock health and productivity	Fisheries yields and aquaculture production	Infectious diseases	Heat, malnutrition and other	Mental health	Dis-placement	Inland flooding and associated damages	Flood/storm induced damages in coastal areas	Damages to infra-structure	Damages to key economic sectors
Global	±	−		−	−	−	−	−	−	−	−	−
Africa	−	−	−	−	−	−	–	−	−	−	−	−
Asia	±	±	−	−	−	−	−	−	−	−	−	−
Australasia	±	−	±	−	−	−	−	not assessed	−	−	−	−
Central and South America	±	−	±	−	−	−	not assessed	−	−	−	−	−
Europe	±	±	−	±	−	−	−	−	−	−	−	−
North America	±	±	−	±	−	−	−	−	−	−	−	−
Small islands	−	−	−	−	−	−	–	−	−	−	−	−
Arctic	±	±	−	−	−	−	−	−	−	−	−	±
Cities by the sea				−		−	not assessed	−		−	−	−
Mediterranean region	−	−	−	−	−	−	not assessed	−	±	−		−
Mountain regions	±	±	−		−	−	–	−	−	n/a	−	−

Confidence in attribution to climate change

- High or very high
- Medium
- Low
- Evidence limited, insufficient
- n/a Not applicable

Impacts to human systems in panel (b)

- − Increasing adverse impacts
- ± Increasing adverse and positive impacts

Source: IPCC (2022), https://www.ipcc.ch/report/ar6/wg2/downloads/report/IPCC_AR6_WGII_SummaryForPolicymakers.pdf, Page 12.

The question we address in this chapter is how climate change affects the expected returns of asset classes. This is the second year we include climate change as a separate chapter in this publication. Research into the effects of climate change on asset class returns is still scarce and marked by uncertainties. In this year's publication, we have aimed to further enhance the structure of our analyses. We therefore start by outlining a theoretical analysis of how climate change may affect asset prices, and what this means for expected returns in general. Moreover, we divide risks into physical risks and transition risks, as both may have a very different effect on corporates and governments. Our macroeconomic analysis explicitly links to the Kaya identity[3], examining how economic growth and energy and carbon efficiency are linked. This is the basis of the final section, in which we assess the impact of climate change on the various asset classes. This enhanced structure leads to better substantiation for our climate signals, which have not changed compared to last year.

3. The Kaya identity is a mathematical identity stating that total greenhouse gas emissions can be expressed as the product of four factors: GDP per capita, population, energy intensity of GDP, and carbon intensity of energy generation. See Kaya (1995) for more details.

3.2 Climate risks: physical and transitional

In order to determine the extent to which climate change is affecting asset prices, we first need to discuss climate risks. Contrary to interest rate risk or recession risk, it is not easy to define what climate change risk is exactly. Penn (2021), among others, argues that it is important to distinguish between two different types of climate change risk: physical risks and transitional risks. The physical risks of climate change such as floods and droughts will increase non-linearly if we continue to emit greenhouse gases as we have done over the past fifty years. The transition risk is the risk of changing regulation or taxes aimed at reducing global greenhouse gas emissions. For example, some business models may not be able to withstand a carbon tax beyond a certain threshold. This transition risk increases with higher government ambitions to curb greenhouse gas emissions.

It seems that policy makers are continuously evaluating these two types of risk. Only recently have we seen some policy action ignited by the frequent natural disasters that cannot be explained by natural climate variability. An increasing number of governments is therefore setting net-zero targets in domestic legislation or policy documents. The Net Zero Tracker (2022) reports that while in December 2020 only 10% of global greenhouse gases was covered in those official documents, this has increased to 65% in June 2022. The 'no action' scenario therefore seems less likely, and the transition risk has become larger.

Relatively little is known about how climate risk ought to affect investors' asset allocation decisions. Cosemans, Hut and Van Dijk (2022) consider only physical climate risks and indicate that long-term climate-aware investors invest less in the equity market than investors who do not take the climate into account. This is because the increased equity risk premium is more than offset by the higher long-term risk of investing in equities due to more frequent climate disasters.

3.3 Impact of climate change on asset prices

We illustrate three different ways in which climate change can impact the realized and expected returns of assets with a simple example that is based on a discounted cash flow analysis:

$$\text{Price}_{t=0} = \sum_{t=1}^{\infty} \frac{E\{\text{Cashflow}_t\}}{(1 + \text{Discount Rate}_t)^t}$$

where E refers to expectations, and expected cashflows are discounted using the appropriate rate that reflects the systematic risk the asset is exposed to. The discount rate is sometimes also referred to as the cost-of-capital of a firm and equals the expected return on the asset.

Suppose there is a financial asset that is expected to give a dividend of 1,000 in 10 years from now. There is considerable systematic risk around this expectation. This risk is the reason that investors command a return of 10% for investing in this asset. Or, put differently, the price of the asset today is 385. Now consider three different scenarios:

In scenario 1, we suppose that after holding the asset for one year, there is some news about a carbon tax that the company is not expected to be able to pass on to its customers. As a result, the market expects that the dividend will no longer be 1,000 but will have dropped to 850. If the introduction of this tax does not affect the systematic risk of the asset, the value of the asset after one year will have gone down to 360, or -6.5% return instead of the 10% that was expected one year ago. However, given its current price of 360 and its expected payoff of 850 in now nine years, the expected return has not changed and remains 10%.

In scenario 2, we suppose that after holding the asset for one year, there is some news that affects the systematic risk of the asset. For example, there is a possibility that in a few years the company needs to purchase carbon allowances at a much higher price than expected, but also that it may not have to purchase carbon allowances at all if it manages to apply a new technology. The expected dividend is unaffected and remains 1,000, but since the risk around this estimate has increased, investors now command an additional carbon risk premium of 2%. This increased risk premium lowers the price of the asset to 360 for a -6.5% return in the first year. However, since the expected cash flows are not affected, but the price decrease is the result of an increase in discount rate, the expected return has increased to 12%. Of course, a similar situation would arise if the systematic risk remained the same, but the market's required compensation for systematic risk increased from 10% to 12%.

And finally, in scenario 3, we suppose that after a holding period of one year, many investors have decided to divest from the asset, because it does not align with the Paris Agreement. In that case, the selling pressure and subsequent lack of demand for the asset could reduce its price also from 385 to 360, leading again to an initial loss of -6.5%. Since the divestment does not directly influence the expected dividend, the expected return for the remaining nine years is 12%. In addition to the 10% required return for its riskiness, the expected return now also includes a 2% 'sin' premium because it is not a sustainable investment.

There are three important lessons to learn from the above example. First, the negative news about an asset's expected cash flow, an asset's systematic risk, or market segmentation (divestment) leads to a negative return for the asset in the short run in the period the new information is being incorporated into the price. The market can only see the asset's price, but which of the three mechanisms is at work is often not clear and analysts may help to provide evidence. Second, after the negative news is incorporated into the asset's price, its expected return may be affected, depending on why the price went down. Therefore, for expected returns it is not enough to know the price of an asset, but it is essential to also understand why prices are the way they are, i.e. whether additional risk or segmentation premiums are incorporated in the asset's price. If such positive premium is included, the carbon-risky or divested asset will have a *higher* expected return. Third, if price changes are caused by news about cash flows, an investor can only outperform the market by being faster or better informed than other market participants. If price changes are caused by news about the discount rate, an investor may outperform in the short run by predicting discount rate changes better than the market, or in the long run by passively holding the risky or unpopular asset with the higher discount rate.

3.4 Impact of climate change on economic growth

Above, we analyzed the two types of climate change risk and how these can affect the discount rate and risk of investing in equities. We will now evaluate how climate change can affect real economic growth, which in turn has an impact on the revenues of companies and the rate at which governments can borrow from investors.

The Kaya identity (1995) is often used to decompose the reduction of absolute greenhouse gas (GHG) emissions into economic growth and renewable energy technology:

$$GHG = \frac{GDP}{P} \times P \times \frac{E}{GDP} \times \frac{GHG}{E}$$

The first two terms are related to economic growth, i.e. the total global Gross Domestic Product (GDP) equals the amount of money earned per person times the population (P). The second two terms describe how much emission is required per unit of GDP, by splitting this up in the energy intensity of economic output and the carbon intensity per unit of generated energy (E). Reduction of total greenhouse gas emissions has to come from one of these four sources. It follows from the Kaya identity that if we want to be on a sustainable pathway and reduce annual greenhouse gas emissions by 17% by 2030, and at the same time increase global real living standards by 1% annually for a total population growth of 6% in 2030, we need to improve energy efficiency and carbon efficiency by 27% in total.[4] The more ambitious target to reduce greenhouse gas emissions by 50% by 2030 would require essentially a 56% improvement in efficiency. Clearly, it will require a substantial amount of innovation to accelerate the energy transition for the world to remain on a sustainable climate pathway without reducing global living standards.

4. This follows from the Kaya identity: $(100\%-17\%) = (1.01)^7 \times 1.06 \times (100\%-27\%)$.

3.5 The price of carbon emissions

If governments put a price on carbon emissions and fail to use the proceeds efficiently, this may result in lower real economic growth and higher inflation. Carbon prices come in a variety of shapes but can be categorized into three main types: carbon tax, cap-and-trade systems, and carbon offsets.

As early as 1990 and 1991, Finland and Sweden introduced a carbon tax with the aim to discourage the use of fossil fuels. Andersson (2019) finds that the carbon tax levied in Sweden has reduced carbon emissions from traffic by 11%. Johansson (2000) furthermore claims that the carbon tax has led to increased innovation in alternative energy generation in Sweden. Aghion et al. (2016) also show that car manufacturers tend to innovate more in clean and less in dirty technologies when they face higher tax-inclusive fuel prices. The essential element of a carbon tax is that it increases the price of a product with a negative externality: carbon emissions. A carbon tax increases the price, resulting in less demand for the carbon-emitting product. This makes products with lower or no carbon emissions relatively more attractive and switching to cleaner energy more financially worthwhile. However, there is no direct control on the quantity of carbon emissions.

Cap-and-trade systems are mandatory systems that require companies to purchase carbon allowances from an authority for each ton of their greenhouse gas emissions. If you want to emit greenhouse gases, you need to acquire these allowances and, upon emission, cancel the allowance in the carbon allowance registry maintained by the authority. The total amount of allowances in a certain jurisdiction is capped, providing the authority with strict control over the quantity of emissions. The price of the carbon allowances can fluctuate to equate supply and demand. In most jurisdictions, carbon allowances can be traded in Emission Trading Schemes (ETS), allowing companies that reduce their carbon emissions to sell their left-over allowances to other companies that need them. Currently, about 15.4% of the world's carbon emissions are covered by such

schemes at an average price of USD 30.[5] Figure 3.2 shows the price of carbon allowances in the European Union, which has skyrocketed to above EUR 80. The size of these markets has grown over time and has become an investable asset class.[6] The carbon tax and the mandatory carbon allowances in cap-and-trade systems do not remove carbon from the atmosphere and in that sense only contribute to meeting the targets under the Paris Agreement because they are aimed at limiting future greenhouse gas emissions.

5. Real Carbon Price Index, https://www.realcarbonindex.org/
6. For more details, see Swinkels and Yang (2022).

Figure 3.2: Price of mandatory carbon allowances in the European Union

Source: Refinitiv, Robeco, Swinkels and Yang (2022).

Projects that aim to sequester carbon from the atmosphere are called carbon offsets. These are mostly offered by private organizations and purchased on a voluntary basis by companies that wish to offset some of the carbon emissions that they currently cannot avoid in their operations. For example, companies can use carbon offsets to compensate for corporate travel by their employees. The three main disadvantages of carbon offsets are that they divert attention from lowering carbon emissions, involve intermediation fees that are opaque, and that the quality of the carbon offsets varies considerably.

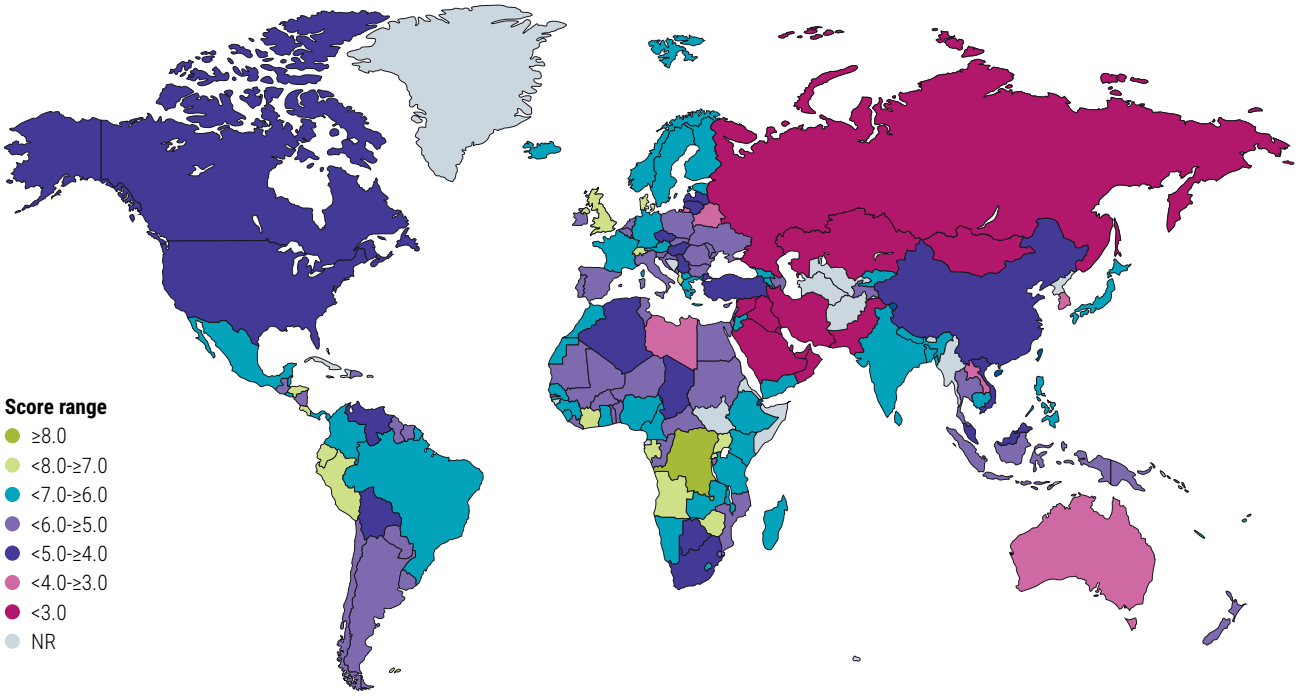
3.6 Impact of climate change on asset classes

Against this background, multi-asset allocators need to assess the impact of climate change on each asset class, as it may affect their expected returns for the next five years differently. In this section, we examine the climate change risks across the main asset classes and the implications on expected returns.

3.6.1 Government bonds

What is the cost of climate change if no climate action is taken? The answer to this question depends on many assumptions: how do temperature increases translate into severe weather events, how much damage do these severe weather events cause, and how costly is adaptation to climate change, including political tensions due to mass migration away from less habitable parts of the world. The cost of 'no action' must be offset against the cost of climate policies. Both are costly, so we expect that real economic growth will be lower compared to the time when carbon emissions were considered to be harmless and free. The 'no action' scenario is becoming less likely, as more governments are committing to net-zero ambitions via legislation and policy documents.

Figure 3.3: Robeco's country climate and energy score



Source: Robeco. Scores range from 1 (worst) to 10 (best). Scores as of April 2022.

Since government bond returns tend to be positively related to real economic growth, we expect that interest rates will be lower than in a scenario without climate risks. In the short term, up to 2030, Inevitable Policy Response[7] predicts that the global real economy will contract by 1.2% (0.15% per year) compared to a business-as-usual scenario. According to their model, these real GDP losses are incurred in the short run but recovered in 2050. Penn (2022) surveys fifty-five academic studies on the effect of climate change and finds that the estimates vary considerably depending on the methodology used and geography examined but finds an annual 0.3% lower global GDP a realistic synthesis.

As discussed in the special topic on the inflationary effects of the energy transition that is part of this publication, avoiding climate change may also give an added impulse to price increases. This in turn may motivate investors to demand higher yields to finance governments, which adds to expected sovereign bond returns in nominal terms.

However, not every government is equally vulnerable to climate change and the energy transition. We have developed a Country Sustainability Ranking[8] which contains a climate and energy sub-score. This sub-score is based on indicators such as country carbon efficiency, the share of renewable energy, and climate risk indicators, and is shown in Figure 3. If we look at the large government bond markets, the UK, eurozone, and Japan have a good score, whereas the US has a relatively low score. Very few countries have a dark green score, so substantial climate transition and physical risks are also present for developed government bond markets.

All in all, we give a neutral climate signal for developed government bonds.

3.6.2 Emerging market debt

It is difficult to separate climate change risk from other credit-related elements embedded in government bond yields. To illustrate this, we can look at the Netherlands. About one-third of the country is below sea level and another third is vulnerable to floods with

7. https://www.unpri.org/sustainability-issues/climate-change/inevitable-policy-response

8. https://www.robeco.com/en/key-strengths/sustainable-investing/country-ranking/

high tides and extreme storms. Its government bond yield is around 2%. Bangladesh is also a country not far above sea level with many large rivers, making it prone to large floods. Its government bond yield is over 8%. The 6% difference between bond yield in the Netherlands and Bangladesh may be partially caused by how climate change affects both countries, but other elements such as political risk and expected government revenues are also likely to play a role. Nevertheless, Beirne, Renzhi and Volz (2021) find a positive relation between climate change vulnerability and government bond yields.

Figure 3.3 shows that the climate and energy score is indigo for several emerging bond markets, such as China and South Africa. However, a substantial number of countries has scores comparable with developed markets. For example, Brazil, Mexico, and India stand out positively from the countries with sizeable government debt markets.

We can identify at least two reasons why credit spreads of countries that are more vulnerable to climate change may be wider than comparable countries with less climate risk. First, the physical risks may be larger, leading to larger government expenses to repair the damage resulting from climate-related disasters such as floods. Second, energy in emerging markets is more likely generated cheaply but with low carbon efficiency, for example through coal-fired plants. Large investments to change to more carbon-efficient technologies are required, and typically the government has to pick up part of the bill. In addition, lower economic growth due to both physical and transition risks may lead to lower tax revenues. This in turn impairs the ability to service debt, exerting upward pressure on emerging market government bond yields via credit spreads, as well as inhibiting real appreciation of emerging market currencies.

In our assessment, there is a negative climate signal for investments in emerging market debt.

3.6.3 Corporate credit

We collect data on climate risk for investment grade and high yield universes to obtain a multi-dimensional look at the climate risk for the corporate bond market. The latest climate data is supplemented by metrics including forward-looking information. Table 3.1 shows the results at index level and for the various corporate credit sectors. The carbon footprint, carbon emissions divided by enterprise value, has become the reporting default in Europe and is the first measure that we evaluate.[9] The investment grade universe has a substantially lower carbon footprint (69.4) than the high yield index (135.1). The Climate Value at Risk measure provides a forward-looking, returns-based valuation assessment of climate-related risks and opportunities in an investment portfolio. In addition to carbon emissions, green patents are an example of a forward-looking measure that is also included. While this metric differentiates between companies within a sector, and hence is important for bond selection strategies, at the aggregate level it does not seem to provide a different picture than the one for carbon emissions. Finally, we examine the implied temperature rise. This reflects the company's future emission plans and translates it into a global temperature rise (a scenario where every company would follow the same emissions path). Since current carbon emissions form the starting point of the calculation, we see that the energy and basic industry sectors are predominantly responsible for the global temperature rise, and that decarbonization efforts are therefore likely to have the most effect in precisely those sectors.

9. Due to data quality, this is currently limited to Scope 1 and 2, but in the future it will also include Scope 3 emissions.

We found that carbon-emitting corporates are more prevalent in high yield indices than in investment grade. This may be due to climate change risk already materializing and carbon-intense companies becoming less creditworthy for long-run debt. However, it can also be due to the heavily fluctuating energy prices over the past couple of years, which materially affect the expected cash flows from operations from carbon-intense

companies. Blitz (2022) shows that investors who divest from fossil fuel companies are implicitly exposing their portfolio to oil price increase risk compared to investors who invest in the entire stock market. Energy price increases over the past year may have also benefited the financial health of companies in these sectors. Upgrades from asset class high yield to investment grade combined with higher enterprise values may have led to the lower carbon footprint of the index, which stood at 164.5 last year. However, since carbon-intensive sectors are still overrepresented in high yield indices compared to investment grade, we expect a negative impact from a climate perspective.

As for emissions at asset class level, investment grade receives a neutral climate signal, and high yield a negative climate signal.

Table 3.1: Climate change risk metrics for corporate bonds

	Index weight (%)		Carbon footprint		Climate Value at Risk		Implied temperature rise	
	IG	HY	IG	HY	IG	HY	IG	HY
Index	**100.0**	**100.0**	**69.4**	**135.1**	**-13.8**	**-22.6**	**2.5**	**2.9**
Electric	6.5	2.9	396.9	1,046.2	-13.3	-28.4	2.7	3.1
Energy	6.1	10.1	267.1	240.0	-47.4	-63.7	5.1	7.9
Basic industry	2.9	5.8	311.8	636.2	-40.2	-57.4	4.5	5.6
Capital goods	4.6	8.6	125.1	209.7	-6.5	-14.9	3.1	2.6
Transportation	3.1	3.6	109.7	256.7	-25.3	-64.0	2.2	2.6
Consumer non-cyclical	13.5	11.6	18.6	39.1	-16.2	-19.5	1.8	1.9
Natural gas	1.2	0.1	163.4	280.5	-46.3	-59.4	3.1	2.9
Consumer cyclical	7.3	19.2	19.3	34.9	-12.4	-13.7	3.2	3.4
Utility other	0.6	0.4	157.8	261.8	-28.8	-46.9	2.1	2.9
Communications	7.8	17.0	8.5	8.7	-19.2	-15.3	1.5	1.5
Technology	6.7	5.2	7.2	14.0	-2.4	-5.6	1.6	2.0
Industrial other	0.7	1.5	50.2	105.9	-34.6	-9.4	3.9	1.8
Insurance	6.0	2.2	5.2	3.5	-12.8	-17.8	1.6	1.4
Financial other	2.0	2.9	10.0	11.7	-18.0	-6.6	1.8	2.9
REITs	2.9	1.5	6.7	7.5	-6.8	-13.5	1.8	1.9
Banking	25.5	4.8	0.3	0.8	-4.7	-8.4	2.0	2.4
Finance companies	1.1	1.9	2.5	3.6	5.5	-4.8	6.3	1.6
Brokerage, asset managers, exchanges	1.5	0.8	1.1	2.7	-2.2	-10.8	2.6	1.7

Source: Robeco, Robeco Indices, Refinitiv Datastream, MSCI, TruCost, MSCI ESG Research. The data was obtained in June 2022. Certain information ©2022 MSCI ESG Research LLC. Reproduced by permission.

3.6.4 Developed market equities

The key question for equity investors to consider is how climate change will impact the cashflow generation abilities and the discount rate of the typical company in its assessment of net present value. Losses can be due to physical risk, for example when droughts or floods damage the production facilities, or due to transition risk related to new energy sources, by investments in clean technology or an increased price to emit carbon. Companies innovating for the energy transition may also benefit from climate change risk. Dietz et al. (2016) estimate that the 2 °C scenario would even result in a 0.2% higher net present value of financial assets compared with a business-as-usual scenario, suggesting that climate-mitigating policies are a net positive for investors.

In the long run, one expects earnings growth to equal long-run economic output growth. If GDP per capita growth is structurally impaired by climate change, there can also be repercussions for the long-term earnings growth potential of companies. A predicted decline of 20% for global GDP would imply global corporate earnings growth falls by around 0.5% per year between now and 2050. As emerging markets are more vulnerable to climate change risks, earnings growth in emerging markets is expected to fall by more than this global average.

In terms of the discount rate, we have to account for the secular decline in the risk-free rate and the increase in the implied equity risk premium. Balvers, Du and Zhao (2016) show that uncertainty about temperature shocks increases the cost of equity by 0.22% per year. In the next five years we expect more equity investors to start or continue to scrutinize the downside risks that could result from climate change, leading to a larger discount rate on certain equity markets.

Applying the same method we used for corporate bonds, we assessed the carbon risks of different sectors, both in developed and emerging equity markets. We evaluated carbon footprint, Climate Value at Risk, implied temperature rise, and this time also climate beta. This is a proprietary Robeco measure that indicates how sensitive the return of a stock is to the excess return of a polluting-minus-clean factor. A higher climate beta indicates higher climate risk. Our methodology is inspired by the work of Huij, Laurs, Stork, and Zwinkels (2022). At index level, developed and emerging markets are not particularly sensitive to the climate beta, but the energy sector in developed markets has a very large climate beta of 0.92. Surprisingly, the climate beta of the utilities sector in developed markets is negative, at -0.22. In general, the climate beta of emerging markets equity sectors is low, and its absolute value does not exceed 0.1.

We expect a negative but limited impact on overall expected equity returns from the repricing of climate risk over the next five years.

Table 3.2: Climate change risk metrics for equities

	Index weight (%)		Carbon intensity		Climate Value at Risk		Implied temperature rise		Climate beta	
	Dev	Em	Dev	Em	Dev	Em	Dev	Em	Dev	Em
Index	**100.0**	**100.0**	**53.9**	**161.6**	**-10.7**	**-22.1**	**2.3**	**3.3**	**0.05**	**-0.03**
Energy	5.2	9.1	303.4	857.3	-51.3	-52.3	6.7	4.4	0.92	-0.09
Materials	4.6	2.7	316.2	1259.6	-33.5	-57.0	4.6	5.2	0.03	-0.06
Utilities	3.1	5.0	407.4	490.5	-27.1	-82.0	3.0	6.9	-0.22	-0.06
Industrials	9.9	5.5	46.7	156.7	-4.3	-22.6	3.2	3.2	-0.06	0.08
Consumer staples	7.4	21.1	25.9	33.9	-24.4	-9.5	1.9	2.4	0.01	-0.06
Consumer discretionary	10.7	12.8	12.7	28.8	-4.6	-12.6	2.5	3.0	-0.21	0.03
Information technology	21.4	6.0	4.3	51.2	-0.9	-30.0	1.6	2.5	0.05	0.00
Financials	13.9	10.2	5.5	9.6	-6.2	-15.7	1.9	1.6	-0.06	-0.06
Health care	13.4	3.6	4.5	15.2	-7.4	-11.0	1.6	1.7	0.14	0.04
Communication services	7.5	21.8	3.9	2.3	-8.7	-12.6	1.5	2.6	0.13	-0.08
Real estate	2.8	2.1	7.4	18.1	-10.5	-16.0	1.9	1.7	0.05	0.04

Source: Robeco, Robeco Indices, Refinitiv Datastream, MSCI, TruCost, MSCI ESG Research. The data was obtained in June 2022. Certain information ©2022 MSCI ESG Research LLC. Reproduced by permission.

3.6.5 Emerging market equities

Table 3.2 shows that climate risk metrics are worse for emerging markets compared with developed markets, with the exception of the climate beta, which is close to zero for both developed and emerging markets. For example, the carbon footprint of emerging market equities is 161.8, more than three times higher than that of developed markets (53.9). The Climate Value at Risk is roughly twice as high for emerging markets (-22.1) compared to developed markets (-10.7). And the implied temperature rise of emerging markets at 3.3 is a full degree above that of developed markets at 2.3. The last measure, climate beta, shows no meaningful difference between emerging markets (-0.03) and developed markets (0.05).

Since most climate risk measures indicate that emerging market equities are more vulnerable than developed markets when it comes to climate change risk, we give a negative climate signal for emerging markets compared to developed markets.

3.6.6 Commodities

Climate change seems to be a double-edged sword when it comes to commodities. On the one hand, demand for commodities might decrease as global economic activity slows. On the other hand, increased physical risk resulting from climate change could see more frequent negative supply shocks hitting commodities, especially agricultural commodities. Furthermore, any negative supply shocks that occur may take longer to unwind than previously because of a lower price elastic supply response from commodity producers assuming climate risk raises the cost of capital for commodity producers and increases their breakeven prices.

The impact on expected commodity returns under a business-as-usual scenario could be neutral. However, in the scenario of progress towards the Paris climate targets and the green energy transition, the commodity intensity of economic activity could increase. The battle against climate change is resulting in increased demand for certain commodities. For example, an electric vehicle uses on average 83 kg of copper, while a similar vehicle based on the internal combustion engine uses just 23 kg. Meanwhile, the International Energy Agency notes that 90% of new electricity capacity in 2020 stemmed from renewable sources such as wind and solar. Steel is vital in the production of renewable energy, much like copper is for the electric vehicle industry: each new megawatt of solar power produced requires around 40 tons of steel, while each additional megawatt from wind requires 120-180 tons. Renewable energy consumption as a percentage of total global energy consumption is expected to rise to 17% by 2030 in the International Renewable Energy Agency's planned energy scenario. This rise implies that a greener economy could be benign for commodities.

On balance, we give a positive climate signal to commodity markets, as we expect climate change will have an upward pressure on commodity prices.

3.7 Summary

The exact magnitude of climate change over the next decades is uncertain, and its impact – and that of the policies and regulations to combat it – on asset prices is even more uncertain. However, this uncertainty does not absolve asset allocators from the task of considering the long-run impact of climate change on asset class returns. The nature of the path from the current situation to the long-run equilibrium is likely to have substantial implications for most investors' decisions. An example of this is how the price of carbon emissions will change across regions over time.

We have presented data and argued that there is little to no impact from climate change on developed government bonds and investment grade corporate bonds. For developed market equities, there is a slightly negative signal due to both lower economic growth and physical risks. These risks are amplified for high yield bonds, emerging market debt, and emerging market equities, which we give a negative climate signal. Commodities are the only asset class that receives a positive climate signal, mostly because the energy transition and physical climate risks will put upward pressure on commodity prices. ●

Special topics

Long-term investors generally face long-term challenges. In this section, however, we address four topics that institutional investors may very well be facing right now or in the near future.

SPECIAL TOPIC | GLOBALIZATION

The emerging trade-off in global trade

"We are now living in a totally new era," said Henry Kissinger, former US secretary of state and national security adviser, in an interview with the Financial Times in May 2022. His words were echoed by Russian President Vladimir Putin at the Saint Petersburg International Economic Forum in June 2022, who declared that "the era of a unipolar world order has come to an end". The ship of hyperglobalization has sailed. Captains of industry now need to navigate a new phase of slowbalization amid an economic order that is increasingly fragmenting and susceptible to external impact. A critical rethink seems underway as global corporations, accustomed to just-in-time deliveries in recent decades, are recalibrating their supply chains towards just-in-case spurred by governments focused on strategic autonomy. This shift could change the nature of globalization and have repercussions for multi-asset investors as global corporates may start to trade in Ricardian efficiency[1] for sustainability and resilience.

1. Ricardo (1817).

Ricardo's comparative advantage

Globalization, as defined by professor of history and international affairs at Princeton University Harald James,[2] is the "movement of money, goods, people, ideas, technologies, and cultures across frontiers". As such, globalization is a multi-faceted concept that tries to capture flows as opposed to stocks. It was the nineteenth century British economist David Ricardo who came up with the economic logic as to why these cross-border flows of money, goods and people are a good idea in the first place.[3]

2. https://www.imf.org/external/pubs/ft/fandd/2016/12/james.htm

3. See footnote 1.

Ricardo argued that international trade contributes to greater global wealth as each country specializes and trades by producing the goods in which it has a comparative advantage. A country has a comparative advantage in producing a good if the opportunity costs of producing that good in terms of other goods are lower in that country than they are in others. The opportunity costs are determined by the relative availability of domestic production factors labor and capital. If you are twice as efficient in producing computer chips compared to car parts, you should specialize in computer chips even if you are more efficient in producing both items compared to other countries (the latter posing a mere absolute advantage). Thus, Ricardo argues, relative factor productivity should drive trade patterns between countries and improve overall economic welfare. Empirical studies have confirmed his thinking.[4]

4. See for instance Bernhofen and Brown (2005). For Japan, after opening up its economy in the 19th century, gains from trade amounted to 8-9% of GDP.

Globalization has already morphed into slowbalization

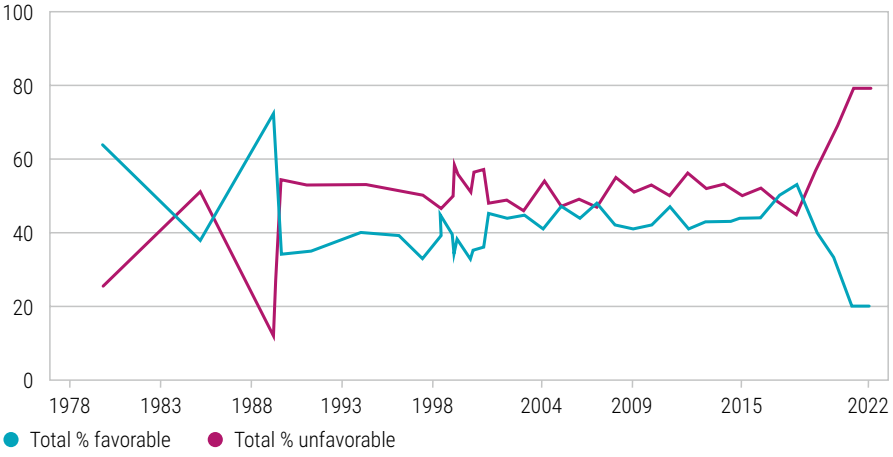
Is the global economic order now turning anti-Ricardian? At first glance, this seems true. First, in contrast with the 1990s and early 2000s, global leaders, governments and citizens no longer see globalization as a welcome force of nature that is futile to resist. For instance, Harvard professor Dani Rodrik finds that globalization shocks and the resulting, increasingly negative view of globalization were instrumental in generating support for populist movements that helped Trump to his 2016 presidential election[5] and adopting his protectionist policy stance.

5. Rodrik (2021).

So while an increasingly interwoven global economic structure might have lifted many out of poverty in emerging markets in the past decades, in the West, the benefits of globalization have not been felt equally as domestic industries had to face new competition from China. US popular opinion about China, still the powerhouse of cheap global labor supply, has notably shifted during the Trump administration, with 79% currently sharing an unfavorable view of the country.

Figure 1: Big shift in US opinion about China

Is your overall opinion of China very favorable, mostly favorable, mostly unfavorable or very unfavorable?



Source: Gallup

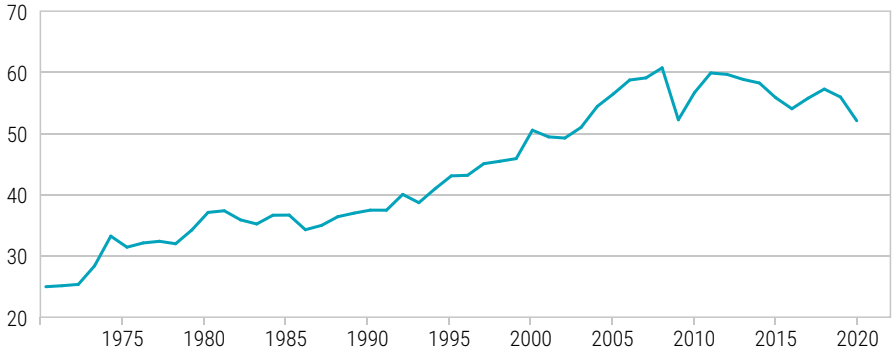
Creating a level playing field with China has also remained a priority in the Biden administration, with US President Biden declaring: "We have to push back against the Chinese government's economic abuses and coercion that undercut the foundations of the international economic system".[6]

6. https://www.whitehouse.gov/briefing-room/speeches-remarks/2021/02/19/remarks-by-president-biden-at-the-2021-virtual-munich-security-conference/

Secondly, the tide of hyperglobalization had already started to recede before the Trump era, evidenced by a decline in the flows of goods, capital and people across borders. Global trade in goods peaked as a share of global GDP in 2008: global foreign direct investment (FDI) inflows peaked around 2007, and global migration flows to developed economies like the eurozone also peaked before the global financial crisis. In the US, average annual immigrant population growth declined from 4.6% in the 1990-2000 decade to just 0.9% in 2015-2019.

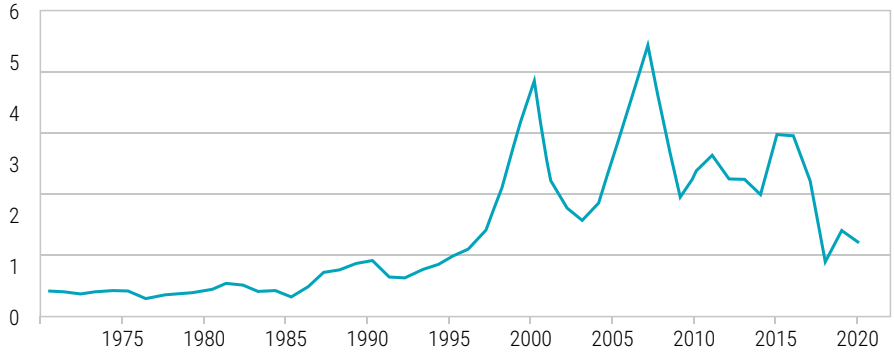
Figure 2: The tide of globalization has already been receding in last decade

Global trade in goods and services as % of GDP peaked in 2008



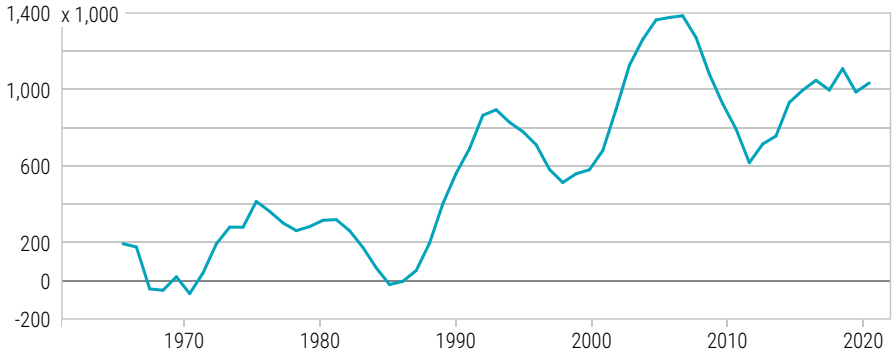
● Trade (% of GDP): Global World International

Global net FDI inflows as % of GDP peaked in 2007



● Foreign direct investment, net inflows (% of GDP): Global World International

Net migration to eurozone peaked before global financial crisis



● 5Y moving average of net migration plus statistical adjustment: Eurozone19 (Eurostat)

Source: Refinitiv Datastream, Robeco

Thirdly, China's globalization footprint has become more measured as it has ascended the GDP-per-capita ladder with a tenfold increase since the early 1990s. Richer economies typically turn more inward and China is no exception. Before the global financial crisis, China's average net exports contribution of goods and services to GDP was 0.5%, post-crisis (2010-2022) this average contribution declined to 0.1%. For the US, the decline in relative openness to trade even pre-dates the 1990s as US trade as percentage of its GDP declined relative to global trade as a percentage of GDP since the 1970s.

Thus, the phenomenon of slowing globalization or slowbalization is nothing new. However, the Covid shock, the grounding of container ship Evergreen that blocked the Suez Canal causing major disruptions to global trade, and more recently the Russian invasion of Ukraine, all had a reinforcing effect on global supply chain disruptions amid a surge in global goods demand. This has reinvigorated the debate on deglobalization. Increasing labor shortages in developed economies and precautionary inventory buildup (the latter due to widespread uncertainty about delivery times) added stress to a just-in-time supply chain system.

The centrifugal force of geopolitics

Geopolitics has also increased in importance when it comes to supply chain management. A recent survey by Morgan Stanley[7] among 400 C-suite executives shows that a majority of corporates believe geopolitical conflicts have a high to moderate impact on their supply chain strategies. The Russian invasion of Ukraine exemplifies this geopolitical upheaval, with the global political order becoming more fragmented and multi-polar as global superpowers have started to see each other more as potential strategic competitors rather than potential strategic partners. Although Chinese President Xi Jinping made a plea against protectionism in his 2022 Davos address, saying, "China will stay committed to reform and opening up", almost 60% of US exports to China remain subject to tariffs. Likewise, the US has expanded regulatory action on trade with China as the 2022 US National Defense Strategy dubbed China its "most consequential strategic competitor".[8] Strategic competition between superpowers means that less powerful individual countries have to make choices whom to ally with.

The centripetal pull of global economic cooperation is weakening as centrifugal forces like geopolitics and national interests become more entangled in the era of strategic competition between superpowers. China's 2025 plan aims for strategic autonomy in ten high-tech industries by achieving a 70% self-sufficiency ratio. Brussels aims for strategic autonomy as well with EU council president Charles Michel seeing this as "the aim of our generation".[9] In Michel's view, economic security, promoting European values and disseminating European standards are an integral part of this journey. Another example of emerging centrifugal forces is US Treasury Secretary Janet Yellen's proposal to shift the objective from fully liberalized trade to "free but secure" trade.[10] She proposes *friendshoring* as an alternative model. Doing business with countries you know you can count on makes sense as there is ample empirical literature about the positive correlation between trust levels and economic growth.[11] Yet trying to do business exclusively with friends also introduces inefficiencies and this is where the global economic order could show an anti-Ricardian streak in the future.

Supply chain management: balancing efficiency with resilience and sustainability

Echoing the US Treasury Secretary, corporate executives are also signaling the increasing focus on security concerns in supply chain management, with political stability emerging as a key driver of supply chain decision-making in the Morgan Stanley survey mentioned above. Thus, a careful attempt to balance Ricardian efficiency with contemporary security considerations appears to be in full progress to gain closer control of value chains. In addition to building resilience, supply chain realignments are also likely to focus more on

7. Pauker, Zezas, Secker et al (2022).

8. 2022 National Defense Strategy.

9. https://www.consilium.europa.eu/en/press/press-releases/2020/09/28/l-autonomie-strategique-europeenne-est-l-objectif-de-notre-generation-discours-du-president-charles-michel-au-groupe-de-reflexion-bruegel/

10. https://www.atlanticcouncil.org/news/transcripts/transcript-us-treasury-secretary-janet-yellen-on-the-next-steps-for-russia-sanctions-and-friend-shoring-supply-chains/

11. See for instance Zak and Knack (2001).

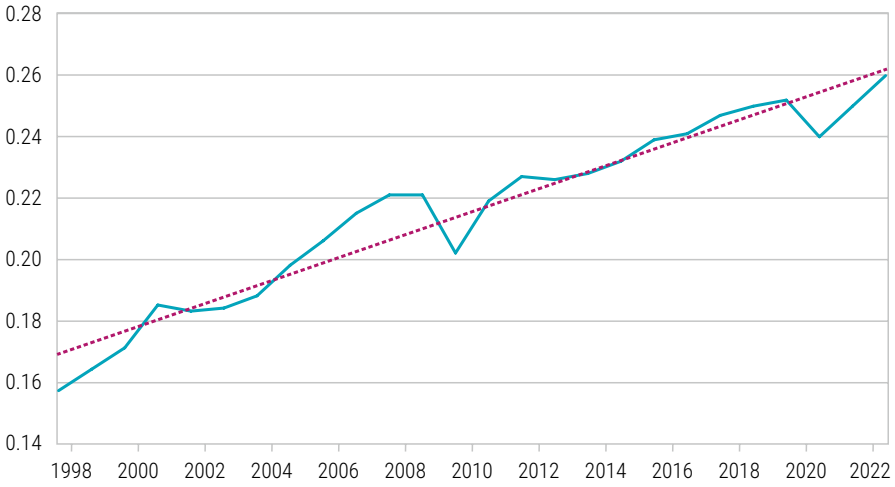
sustainability. As McKinsey notes in an article from June 2022: "the supply chain has a central role to play in the enterprise sustainability transformation".[12] There is an obvious overlap between corporate commitment to reduce emissions and packaging in the supply chain and the Sustainable Development Goals such as SDG 13 on climate action to reduce CO_2 per capita or SDG 12 on responsible consumption and production, to name but a few.

12. https://www.mckinsey.com/business-functions/operations/our-insights/future-proofing-the-supply-chain

Buying time to rethink just-in-time

Far from speeding up the transition of the global economic order from slowbalization towards a more autarkic model, building more resilient and sustainable supply chains first and foremost changes the nature of globalization rather than its course. First, evidence of reshoring remains scant, though admittedly the wheels of supply chain transformation turn slowly and it may take time for underlying cross currents to surface in macro data. The import share as a percentage of GDP for the OECD countries has rebounded after the Covid recession with the overall share staying just below the 25-year globalization era trend.

Figure 3: Import intensity of growth



Source: Refinitiv Datastream, Robeco

Instead, companies seem to have bought time for a more drastic post-Covid supply chain redesign by mainly resorting to dual sourcing of materials and increasing inventory to sales levels, thereby broadening the number of supplier countries. Also, industries are following the example set by Elon Musk, looking to build resilience by increasing vertical integration to secure critical production inputs like battery minerals and semi-conductor supply.

The price of friendshoring

Corporates that effectively pay an insurance premium to safeguard their supply chains should be rewarded by investors for doing so as they mitigate risk in a world that seems increasingly susceptible to external shocks like physical climate risk, wars or viruses. For instance, chip shortages stalled US car production until recently and dented car manufacturing stocks.

Yet there is an optimum supply chain insurance level. With C-suite decision makers likely prone to extrapolating recent negative experiences, overpaying for supply chain risk insurance poses a medium-term risk. Capex directed towards friendshoring, nearshoring or onshoring could deliver lower return on investment and erode margins as resilience and

sustainability become considerations that are just as important or even more important than unit labor cost differentials. In addition, short-circuiting supply chains to move production closer to the end consumer could necessitate duplicating production lines. The impact of overpaying for supply chain resilience could correct itself in the medium term, while the deviation from comparative advantage by prioritizing sustainability could take longer to correct.

Incremental capex towards supply chain diversification could therefore amount to expensive substitution or import substitution, also as it remains doubtful if productivity gains from automation and digital adoption resulting from nearshoring or friendshoring outweigh the opportunity costs incurred from still favorable wage differentials existing in offshore countries that rank low on the SDG scorecard. Evidence on the gains from automation, for example, is lackluster. A 2017 OECD study found that the comparative advantage gains from increased automation are hardly detectable in the data for developed economies as well as emerging markets.[13] Only three-year average robot stocks seem to have a marginally positive statistically significant effect on developed economies' annual activity growth in the longer run (see Table 1). Furthermore, the study found that "robots do not (yet) trigger a reshoring of activities to developed economies". Reshoring could not only be inhibited by subdued gains in comparative advantage but also due to enormous capex costs to be incurred trying to emulate high-tech industry products like semi-conductors at home.

13. https://one.oecd.org/document/DSTI/CIIE(2017)14/en/pdf

Table 1: Effects of growth in robotics on comparative advantage

Dependent var: (annual growth)	Relative comparative advantage											
Sample countries	HDC		HDC		HDC		LDC		LDC		LDC	
Sample period	2000-2014	2010-2014	2000-2014	2010-2014	2000-2014	2010-2014	2000-2014	2010-2014	2000-2014	2010-2014	2000-2014	2010-2014
Robot stock (annual growth)	0.010 (0.01)	0.005 (0.02)					0.008 (0.01)	0.003 (0.02)				
Robot stock (2-year average)			0.016 (0.01)	0.007 (0.02)					0.004 (0.02)	-0.001 (0.03)		
Robot stock (3-year average)					0.026* (0.01)	0.040 (0.03)					-0.004 (0.02)	0.036 (0.05)
Control variables												
Year	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Country*Industry	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
R-squared	0.077	0.178	0.082	0.178	0.091	0.179	0.149	0.165	0.151	0.165	0.153	0.165
Observations	7,420	2,671	6,880	2,660	6,330	2,638	2,607	950	2,415	942	2,215	926

Note: Robust standard errors in parenthesis. Clustering at the country-sector level. Significance: * p<0.10 ** p<0.05 *** p<0.01.
Source: OECD (2017)

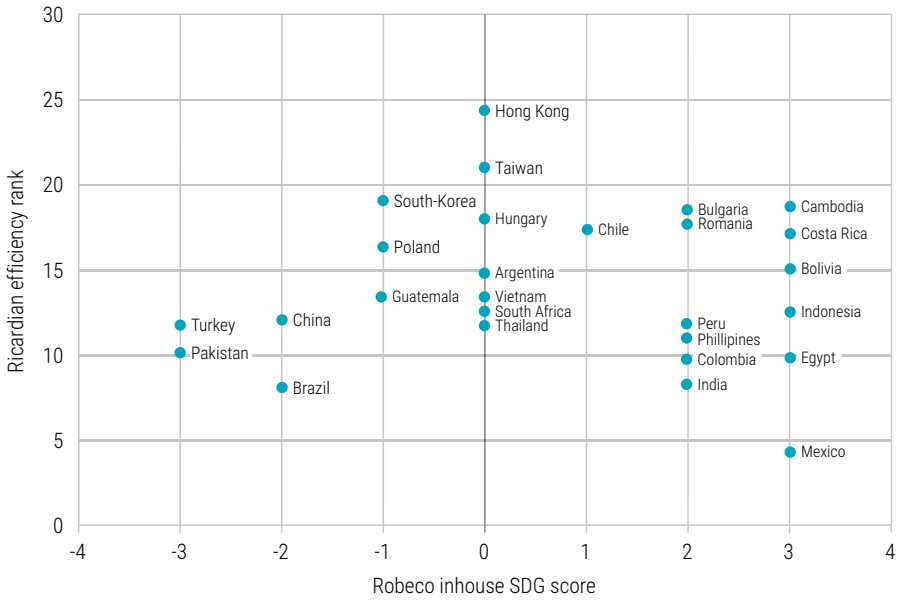
Finding the sweet spot

Which countries stand to benefit from a different kind of globalization that also weighs resilience and sustainability, and thereby implicitly SDG impact-related factors such as the level of democracy, integrity of government, environmental impact and educational attainment?

We expect corporates to increasingly start to balance the Ricardian efficiency-related factors with factors that capture trust and resilience in the medium term. Therefore, countries that score well both on hard as well as softer factors will be in the sweet spot.

We plotted the average rank based on three efficiency metrics (minimum wage in USD, geographical distance to the US and size of the domestic labor force) of 27 emerging market economies against their respective Robeco inhouse SDG score.

Figure 4: Ricardian efficiency rank versus SDG score



Source: Refinitiv Datastream, Robeco

From the scatterplot in Figure 4, Mexico emerges as the ideal nearshoring candidate given the size of its labor force, outstanding SDG score, relatively attractive minimum wage level and geographical vicinity to the US market. As this is well flagged already in the investor community, the more interesting candidates in the sweet spot quadrant in the bottom right corner that corporates might ponder are Egypt and some Latin American countries like Peru, Colombia and Bolivia. Different companies will make different trade-offs between Ricardian efficiency and sustainability, leaving countries like Vietnam, South Africa and Thailand as other potential candidates to diversify away from China.

Implications for multi-asset investors

The slowbalization trend that emerged after the global financial crisis, decelerating growth in cross-border flows, is likely to continue. From a cross-asset perspective this implies that assets with a low beta to slowing global trade intensity of global GDP could have an edge (Table 2). Here, agricultural commodities (see also our special topic on food insecurity) stand out as they have the most negative beta to global trade intensity (as measured by the sum of global goods and services exports and imports as a percentage of global GDP). In a more fragmented world order that is characterized by a decline in cross-border flows, agricultural prices tend to rise as we saw happening in 2022, the year Russia invaded Ukraine. The ranking in Table 2 shows that emerging market debt in local currency could be particularly vulnerable in a multi-polar world as it shows the highest beta in the multi-asset universe with regard to global trade intensity. Total returns in this asset class are highly correlated with the issuing countries' currency returns which are ultimately driven by improving inflation differentials and real productivity growth catch-up, both of which are becoming more endangered in a fragmenting global economy. With emerging market economies typically having a higher food price weighting in CPI baskets compared to developed economies, more frequent disruptions in food supplies resulting from geopolitical upheaval could inhibit currency appreciation in emerging markets versus their western counterparts.

Table 2: Multi-asset classes and respective trade sensitivity

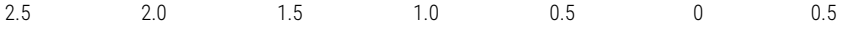
Name	Beta global trade intensity
EMD LC	0.28
IT Benchmark 10 year DS Govt. Index - Tot Return Ind	0.23
BD benchmark 10 year DS Govt. Index - Tot Return Ind	0.14
MSCI EM U$ - Tot Return Ind	0.13
US Dollar index DXY - Price Index	0.07
US benchmark 10 year DS Govt. Index - Tot Return Ind	0.06
ICE BofA Global corporate index - Total Rtn Idx Val	0.06
ICE BofA Global High Yield Index - Total Rtn Idx Val	0.02
MSCI AC Asia Ex Jp U$ - Tot Return Ind	-0.03
ICE BofA Global Government Index - Total Rtn Idx Val	-0.04
Gold, USD FX Comp. U$/troy Oz - Bid Price	-0.14
Swiss franc	-0.42
MSCI World Real Estate $ - Price Index	-0.50
Japanese Yen To US $ (WMR) - Exchange Rate	-0.55
ICE-Brent Crude Oil Trc1 - Sett. Price	-0.56
MSCI World U$ - Tot Return Ind	-0.64
Nikkei 225 Stock Average - Price Index	-0.78
LME-Copper Grade A Cash U$/MT	-0.88
S&P GSCI Softs Total Return - Return Ind. (OFCL)	-2.29

Note: All asset classes 22Y regression on 1Y% total returns, EMD LC 20Y.
Source: Refinitiv Datastream, Robeco

Conducting a similar analysis from a sectoral perspective, the global technology sector emerges as the most negatively correlated with overall trade intensity in goods and services (see Table 3). Technology has thus defied the slowdown in overall global trade in goods and services as a percentage of global GDP. This is illustrated by the fact that international trade in digitally deliverable services has outpaced the overall exports of services during 2005-2019 as reported by UNCTAD in 2022 (see Figure 5).

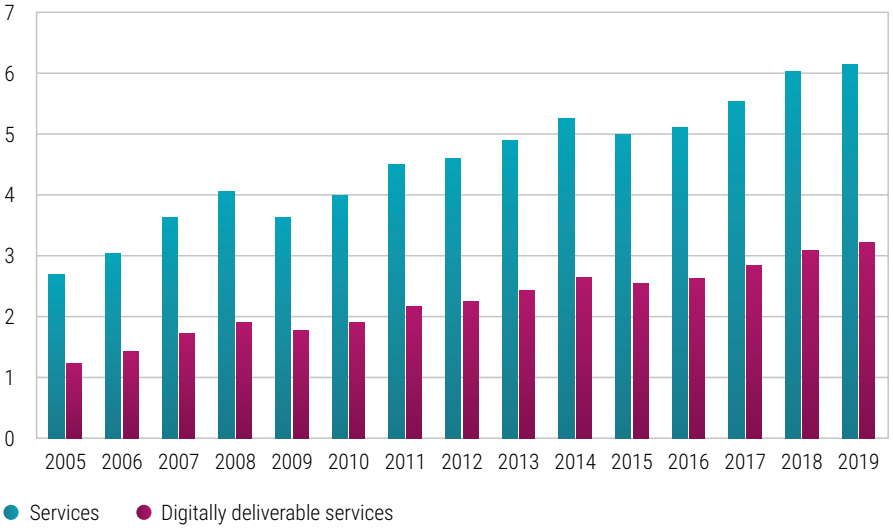
Table 3: Global sectoral trade sensitivity

Name	Beta global trade intensity
WORLD-DS Int. Oil & Gas - TOT RETURN IND	-0.39
WORLD-DS Telecom - TOT RETURN IND	-0.80
WORLD-DS Utilities - TOT RETURN IND	-1.08
WORLD-DS Health Care - TOT RETURN IND	-1.18
WORLD-DS Financials - TOT RETURN IND	-1.29
WORLD-DS Industrials - TOT RETURN IND	-1.41
WORLD-DS Basic Materials - TOT RETURN IND	-1.92
WORLD-DS Consumer Discr - TOT RETURN IND	-1.93
WORLD-DS Consumer Staples - TOT RETURN IND	-1.97
WORLD-DS Technology - TOT RETURN IND	-2.31



Note: All sectors 48Y regression on 1Y% total returns.
Source: Refinitiv Datastream, Robeco

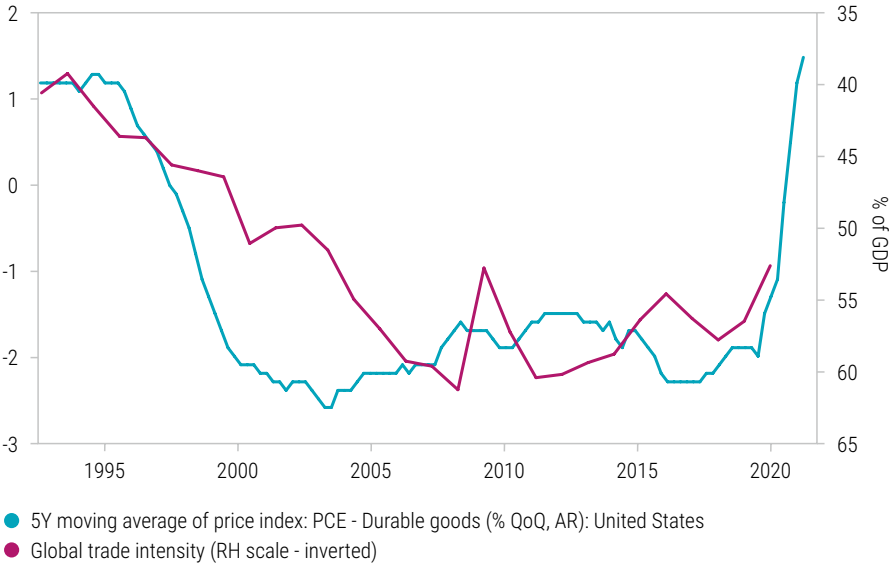
Figure 5: Exports of services and digitally deliverable services (in USD trillions), 2005-2019



Source: UNCTAD database

In addition to the commodity channel, ongoing slowbalization in the goods sector could exert a net inflationary pressure as long as the efficiency losses from a resulting lower degree of global technology spillovers, higher tariffs and import substitution outweigh gains from automation and rapid digitization in the services sector. It is telling that the five-year moving average of US durable goods inflation has inversely moved with global trade intensity, recently becoming positive after exerting a deflationary pressure on US consumer prices for two decades, starting in 2001 when China joined the WTO (see Figure 6).

Figure 6: Durable goods inflation US and global trade (in %)



Source: Refinitiv Datastream, Robeco

Conclusion

Global value chains are like oil tankers: they need careful navigation. Therefore shifts in the nature of slowbalization will be gradual, with companies buying time in the near term through precautionary hoarding and dual sourcing. In the medium term, a potential trade-off between Ricardian efficiency and sustainability could result in a more thorough overhaul of global value chains, given that only a handful countries such as Mexico are able to deliver on both aspects. However, a more robust but less efficient design of global supply chains will challenge corporate profitability. This increases the risk that the anti-Ricardian streak in the coming redesign of supply chains could turn out to be self-defeating. As a paper by the Association of German Industry (BDI) puts it bluntly: "We cannot defend democratic values any better if we considerably weaken ourselves economically."

For multi-asset investors, a more fragmented economic world order with a lower degree of macro-efficiency brings opportunities as well as challenges. Potentially lower GDP growth and higher inflation are traded off in order to gain higher economic security. As we observed in 2022, a stagflationary twist is taxing for most asset classes but benefits commodities. This is confirmed by our analysis showing that commodities like copper have a negative beta to decelerating trade intensity of real activity. On the other side of the spectrum, higher inflation volatility in emerging markets due to more frequent food price shocks could limit the performance potential for emerging market debt in local currency. A pivot away from China could increasingly benefit countries with a better SDG profile, geographical proximity to the US or Europe, and attractive unit labor costs compared to China. However, hesitation to turn away from China as an offshore destination could be strong and pragmatism could still rule the next part of the slowbalization era as painfully few countries, with the exception of Mexico, are really in the sweet spot to offer a compelling alternative. Countries that are already relatively self-sufficient and/or have a technology tilt, such as the US, could have an edge as trade in the digitalization of services keeps outpacing growth in global goods trade. ●

SPECIAL TOPIC | ALTERNATIVE DATA

Gaining an edge with alternative data

In the Napoleonic wars, a group of European bankers set up a Europe-wide network of messengers and carrier pigeon stations which allowed them to gather battleground information as fast as possible. They exploited this information to pick the most advantageous risk positions.

Since then, investors have found obvious and less obvious ways to obtain the information and data that have always been fundamental to investing. In this special topic we discuss alternative data and its impact on the investment industry. We will look at how alternative data differs from traditional financial data, how the asset management industry can use alternative data to make better decisions, and we explore some common questions and challenges the investment industry faces when using alternative data. Finally, we propose ways in which investors can use alternative data to gain an edge.

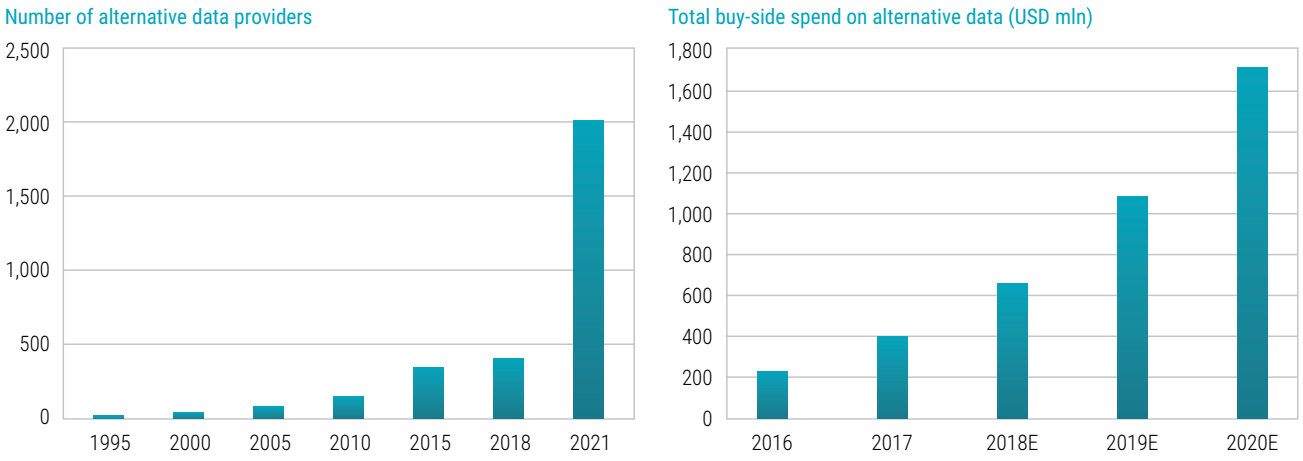
Alternative data is distinct from traditional financial data

Traditional data is financial data and information that, at least since the 1950s, has typically taken the form of financial statements and other company disclosures, such as balance sheets and annual reports, combined with market return and brokerage-created information. This type of data is characterized by coming from a few centralized sources (the company itself, sell-side analysts, exchanges), having a structured data format, and the non-negligible latency between information generation and dissemination.

Since the start of the new millennium, along with the computing and communication revolution (including the internet, mobile phones), the amount and variety of financial data has increased dramatically. In addition to the data mentioned above, financial information is now also collected from unconventional sources (such as satellite images, credit card spending), has an unstructured data format (textual, visual), and possibly low information latency (web blog comments, for example). The financial industry terms these newer sources of information 'alternative data'.

We already gave an example of how investors have been using creative means of data sourcing for as long as investing has been around. In recent years, the amount of alternative data sources has exploded. Azcoitia, Iordanou, and Laoutaris (2021) show that there are now about 180 data marketplaces, 2,000 data providers, and more than 200,000 datasets. Figure 1 depicts the increase in alternative data providers in recent years and shows how much money buyers spend to purchase alternative data.

Figure 1: Alternative data growth in recent years



Source: Robeco, AlternativeData.org, and Azcoitia, Iordanou, and Laoutaris (2021)

Compared to traditional financial data, alternative data sources are characterized by the four Vs: volume, velocity, variety and veracity.

- **Volume:** the amount of information from alternative financial data sources dwarfs that from traditional financial data.
- **Velocity:** alternative financial data creation and dissemination wins the race from the traditional financial data.
- **Variety:** alternative financial data comes in an endless variety, such as figures, text, images, or even audio/video files, and is much richer than traditional financial data.
- **Veracity:** alternative financial data can be crowdsourced and disseminated without rigorous controls and verification and may have a low signal-to-noise ratio, or even be outright false and/or misleading.

Table 1 shows some examples of alternative financial data that are popular at the moment. All these data types contain one or more of the features described above.

Table 1: Popular alternative data sources

employee opinions	demographic information	conference call transcripts	geolocation data
product reviews	biographical description	news articles	shipping information
satellite images	credit card spend	analyst reports	jet flight data
website traffic	point of sale information	supply chain graph	retail store foot traffic
social media posts	compensation information	fund flow information	brand popularity metrics

Source: Robeco (2022)

Investors now also use alternative data and its associated machinery, for example, metadata (see Chang and Da, 2022), in addition to traditional data. The alternative data marketplace is a rich ecosystem, and there are pros and cons to alternative data:

- The advantage is that there is more of it, and it comes at a faster rate. Investors benefit from these features because unique, differentiated, and timely information is an advantage.
- The disadvantage is that the information is unstructured, noisy and can potentially be false. Investors that use alternative data need the skills to extract useful insights and avoid misleading and/or false information.

The increasing reliance of the investment industry on alternative data raises the question of whether there is still a place for traditional financial data. We believe the answer to that question is a clear yes. If the role of data is to provide a true and fair view of the investee company from all angles, then the analogy here is that traditional financial data gives a frontal view of the corporate financial edifice, and alternative data gives a view of the same edifice from the side and perhaps the back (but not an inside view as that view comes from private information). Both traditional and alternative financial data are valuable in the investment industry, and one complements the other rather than replaces it.

How can investors apply alternative data in practice?

The investment community is particularly attracted by the informational advantage alternative data offers. A huge determinant of investment success is whether one has timely, differentiated, and accurate investment insight. As traditional investment data has become commoditized, alternative data provides an opportunity for investors to gain an information edge over others in the marketplace. Given the 4 V features of alternative data (volume, velocity, variety and veracity), taking advantage of alternative data sources in investment processes can lead to different processing, interpretations, and applications, resulting in a lower probability of arriving at the same insight as other investors.

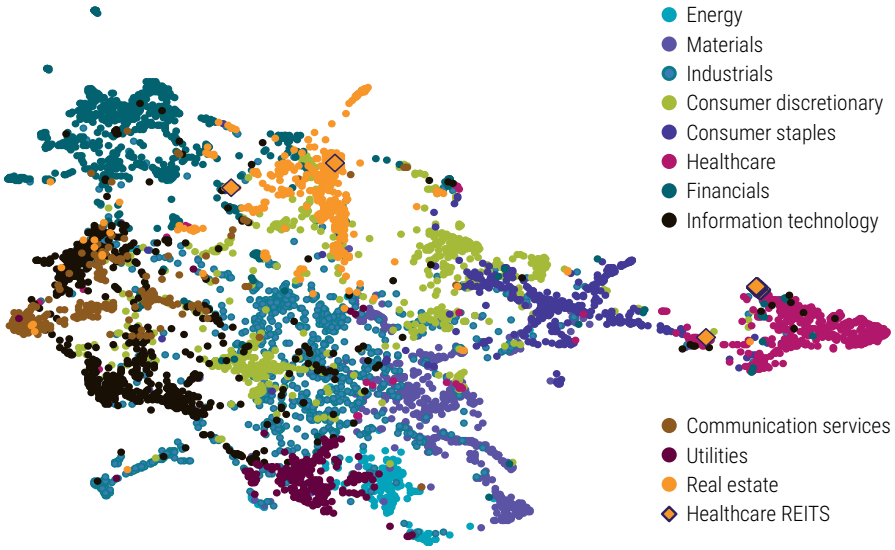
A good example of differentiated investment insights derived from alternative data sources is provided by the Chinese retail investor blogs discussed in Chen, Lee, and Mussalli (2020). They examine the investment discussions of Chinese retail investors to gain insights into sentiments of that important class of investors in the Chinese A-shares market.[1] Investors who read these blogs have an informational advantage of short-term investor flows compared to those who wait for the publication of the next quarterly report.

A further example is industry classifications such as the Global Industry Classification Standard (GICS), which investors commonly use to compare similar companies on the basis of, for example, valuation. The GICS, however, may not be the classification of

1. According to Jones, Shi, Zhang, and Zhang (2020), retail investors contribute 85% of daily trading volume on the Shanghai Stock Exchange, while institutional investors only contribute 15%.

choice for all purposes. For example, the GICS is updated infrequently, while businesses might be more agile in evolving their business model (for example, Amazon). As an alternative to the GICS, investors can use the up-to-date textual descriptions of companies contained in corporate filings to visualize how the latest business and operating models of various companies relate to one another, and possibly extrapolate better-informed corporate classifications. Figure 2 visualizes this classification example. By comparing business description texts and seeing which texts resemble one another, classifications based on company descriptions that are very much alike and those that are not alike at all allow companies to appear grouped together (or not). Colors, on the other hand, indicate the GICS classifications. Fortunately, we see that the same colors tend to be close to one another, indicating that the GICS classifications generally work fairly well. It becomes problematic, however, when a senior housing and healthcare REIT is classified in the real estate sector, whereas its business description puts it closer to the healthcare sector. Investors using alternative data may therefore be in a better position to make relative value judgments compared to those that stick to traditional data.

Figure 2: Business relationships can be visualized and classified using textual description



Source: Robeco (2022)

In addition to investing for alpha performance, alternative data can be essential when it comes to sustainable investing. Traditional sustainability data from corporations, such as data on carbon emissions and the gender diversity ratio, is characterized by even larger information latency than traditional financial data and tends to be backward-looking and sparse. Some of these deficiencies in sustainability data can be resolved by using alternative data sources. For example, examining management communications to understand how a corporation plans to align itself with the energy transition, or analysts' reports to gain an insight into the corporation's plants (and their place in the supply chain) that are in danger of physical risks as the earth's climate changes.[2] And by looking at executives' biographical data and employees' profiles on professional networking websites, for example, analysts can get a sense of a company's diversity – not just along the gender dimension but possibly also along with ethnicity, nationality, age, and education dimensions as well.

2. For example, Bingler, Kraus, Leippold, and Webersinke (2022) find that climate commitments are often imprecise, inaccurate, and greenwashing-prone.

Alternative data in fundamental and quantitative investment processes

So how do institutional investors use alternative financial data in their investment process? This process is generally delineated by their investment approach, which can broadly speaking be split into quantitative or fundamental. Of these two, quantitative investors were the early adapters, and they have been using alternative data on a large scale. The investment process of quantitative investors involves establishing an investment hypothesis, which is then tested through statistical and mathematical analysis of financial data. It is the classical scientific approach. The wide availability of alternative data broadens the types of investment hypotheses quantitative investors can investigate. For example, suppose we want to examine if better employee morale leads to a company's long-term outperformance. This question is impossible to answer if you only use financial statements or stock price data, as that will not tell you whether a company's employees are motivated or not. However, using information from websites such as Glassdoor, researchers can examine whether systematically investing in companies with high employee sentiment will outperform investments in companies with low employee sentiment.[3]

In portfolio construction, a quantitative investor may deploy alternative financial data to create investment solutions for asset owners that previously seemed unattainable. For example, suppose a sustainability-minded asset owner wants to only invest in portfolios aligned with certain UN SDGs. Using UN SDG rankings created on the basis of a systematic natural language processing analysis of sustainability reports, in addition to other information sources about the firm's products and services, the portfolio manager can then feed those rankings into a portfolio construction algorithm to ensure the overall portfolio and all the individually held stocks within it meet or even exceed the SDG rating specified by the asset owner.[4]

Compared to quantitative investors, fundamental investors in general have not adopted alternative data in their investment process to a similar extent. In the fundamental investing approach, investment decisions are ultimately based on the judgment of individual managers. Under this approach, individual analysts and managers examine data from company financial statements, market information, and so on (traditional financial data), speak to company management, and observe the popularity and adoption of various products and services. Thus, much of the hard-to-quantify or intangible information encapsulated by alternative data is observed directly or indirectly via human activities, which may be one of the causes of the lower uptake of alternative data.

Another reason for the lower prevalence of alternative data among fundamental investors is that the technical skills and infrastructure required to use such data are often missing, as fundamental managers usually do not deploy these skills and tools. However, despite the fact that fundamental managers appear to exploit alternative data less, more and more of them are starting data science operations to process and use the information contained within alternative data. We believe this is because, just like quantitative managers, fundamental managers also think that alternative data can provide an informational advantage in their investment processes.

Frequently asked questions about alternative data

Where can I find alternative data sources?

Nowadays, there are many channels through which to acquire alternative financial data. The simplest and perhaps most common approach is to go to alternative data aggregators and brokers, such as Neudata or Eagle Alpha. These companies do not own alternative data themselves, but rather know the alternative data landscape and can introduce

3. For example, Filbeck and Zhao (2022) use Glassdoor employee feedback to form portfolios of the best places to work and find higher, but not statistically significant, returns for companies that are liked by their employees.

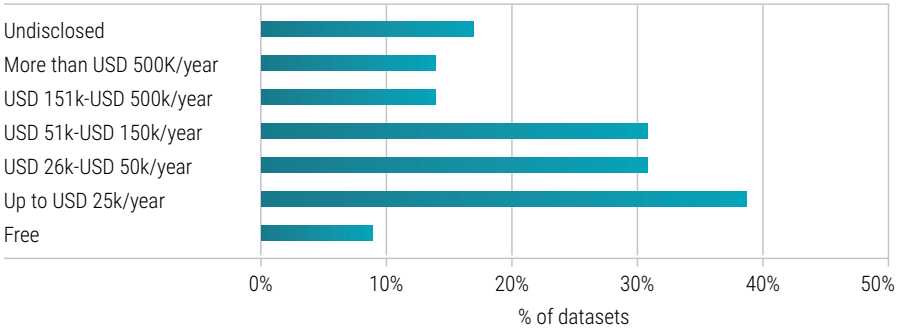
4. See, for example, Chen, Mussalli, Amel-Zadeh, and Weinberg (2022) for an SDG classification based on natural language processing of corporate sustainability information.

investors to various alternative data sources in the marketplace. Another popular channel is traditional financial service providers such as Bloomberg and FactSet, who now also provide alternative data alongside traditional financial data. These two channels are popular as they represent a one-stop shop for alternative financial data and often also conduct due diligence checks of data vendors and sources, which is a critical step in onboarding and using alternative data.

How much do alternative datasets cost?

New users of alternative data may be surprised to learn that alternative datasets do not cost as much as one might imagine. Years ago, when alternative financial data was relatively new to the investment data scene (early 2010s), alternative data vendors may have charged high prices (some millions of USD) to investors to purchase the data, even for datasets with a low breadth and non-granular information. Those days have gone now, and nowadays most alternative datasets change hands for below USD 100,000, even datasets with high coverage and detailed information. Azcoitia, Iordanou, and Laoutaris (2021) report that the median dataset price is currently around USD 17,000 per year. Figure 3 shows the distribution of alternative data price according to Neudata (2022), demonstrating that the most common cost of a dataset is up to USD 25,000 per year.

Figure 3: Distribution of alternative data price as of April 2022



Source: Neudata (2022)

The reason for this dramatic reduction in data price is that, for specific alternative data sources, many vendors are competing for business. Furthermore, investors often realize that while alternative data can provide unique and differentiated information, one information source alone often does not provide the full insight necessary to confidently determine if a security will go up or down. This is because the market security price is a confluence of all possible information that may affect its price, from macro conditions to company-specific information to investors' positioning and sentiments. It is rare that a single piece of information can uniquely determine a security's price and as a result, the cost of that information must adjust to this market reality.

What is required to onboard and process alternative data?

Many investors realize, after they have used alternative data for a while, that the bottleneck is not finding alternative data but rather having the technical skills and infrastructure required to onboard and process alternative data. Compared to traditional financial data, alternative data is higher in volume and complexity. So, whereas traditional financial data can be stored in spreadsheets and processed with simple statistical tools such as linear regression, alternative data requires more robust and sophisticated tools such as a data lake to store the data due to its size, and advanced statistic tools like machine learning to process it due to its complexity and unstructured nature. This high technological hurdle is the reason why quant investors adopted alternative data earlier. In recent years fundamental investors have also established dedicated investment science

teams to onboard, process, and bring to surface information and knowledge contained within alternative datasets as the siren call of information advantage promised by alternative data is too powerful to ignore.

Which dataset should I pick?

Experienced alternative data users all face another common problem: which alternative dataset should they investigate? Although investors can often trial alternative data in their investment process for free (because vendors want to sell their data, after all), the time required to properly investigate if a dataset actually adds value is still significant and represents a real cost to investors. This is a common problem and as a result, in many cases, investors cannot test as much data as they would like. From our own experience and conversations with industry practitioners, experienced alternative data users typically only onboard five to ten new alternative datasets per year. Part of the reason for this low quantity of data onboard is because of the time requirement.

Conclusion

Timely, differentiated, and accurate company information is key for investment success. As traditional investment data is commoditized, alternative data provides an opportunity for investors to gain an informational edge. Alternative data distinguishes itself from traditional data by the four Vs: volume, velocity, variety, and veracity. Successfully exploiting alternative data therefore requires other technical skills, infrastructure, and research methodologies compared with traditional data. To stay ahead of other investors in the marketplace, investments in alternative data are essential.

However, alternative and traditional data also have a lot in common: they are both 'just data'. Ultimately, it is the investors that create the real value in the investment process by transforming the data into actionable portfolio decisions irrespective of whether they are part of a quantitative or fundamental investment style. Based on alternative data, we can ask more interesting research questions and create more value through enhanced performance and investment solutions that are better aligned with client goals and restrictions.

Both quant investors and fundamental investors need skills, creativity, and passion to create value for their clients. So in the end, although alternative data represents a new and interesting dimension on how to create value, the fundamental ingredient and mechanism of investment value creation remains the same. And that fundamental component is having outstanding people who are passionate about their work. Since at Robeco every investment decision must be research-driven, we have been and will continue to be a prolific user of alternative data. We will continue to push the frontiers of investment science. ●

SPECIAL TOPIC | ENERGY TRANSITION

The energy transition comes with a price tag

The impact of the energy transition on consumer price inflation has risen sharply in many countries over the past few years. It is currently a key focal point for financial markets and many consumers. Exploring three main scenarios as well as earlier studies on the inflationary impact from carbon taxation and climate change, we provide an assessment of the possible impact on consumer price inflation in the EU up to 2050. As decarbonization defacto equates to factoring in the cost of a negative externality that was not sufficiently taken into account before, there should be little surprise that there is likely a price to be paid by consumers. But as long as energy supply is safeguarded and the effects on the most vulnerable households are cushioned, it is a necessary price to pay to mitigate the worst effects of climate change. The smoother the transition, the smaller the upward pressure on inflation will likely be. Investors are well-advised to brace themselves for a more volatile inflation backdrop.

Introduction

Over the past years there has been increased research focus on the macroeconomic consequences of the energy transition away from carbon-emitting fossil energy sources such as oil, natural gas and coal towards renewable energy sources like wind, solar and hydropower. While many studies have centered on the implications for economic growth, there is increased attention – including from central banks – for the impact on consumer price inflation, either from climate change itself or from policies enacted to facilitate the transition.

This special topic summarizes some of the recent research findings and presents our qualitative and quantitative assessment of the possible impact on consumer price inflation up to 2050, when the transition to net-zero carbon emissions is aimed to be fully completed. Our geographic focus is on the EU but we will also touch upon the impact for the US, and try to assess the inflationary impact during the transition phase under three main scenarios. These are based on the various scenarios constructed by the EU Commission[1] and IEA[2] are described below:

1. **'Status quo' scenario** – based on prevailing policy settings;
2. **'Carbon taxation' scenario** – which assumes that EU governments step up efforts towards reaching net zero by extending carbon pricing by means of carbon taxation;
3. **'Regulatory rush' scenario** – under which the shift towards renewables away from fossil fuel is assumed to be increasingly driven by regulatory policies.

Following ECB Governor Isabel Schnabel (March 2022) we identify three channels through which the inflationary impact of the energy transition will be gauged:

1. **Climateflation** – which results from price increases prompted by climate change itself, for example, through the increased number of natural disasters or extremely high temperatures resulting in crop failures;
2. **Fossilflation** – which reflects the increased cost of fossil energy sources, partly emanating from the fight against climate change itself;
3. **Greenflation** – which stems from the increased demand for and investment in renewable energy sources, and includes price increases of critical inputs for green technologies.

Over the past few years, the eurozone in particular has, as a net energy importer, experienced how the energy transition can contribute to fossilflation. In Germany, for example, a reduced reliance on fossil and nuclear energy sources amid recovering energy demand arguably contributed to the sharp rise in wholesale gas and electricity prices in the second half of 2021 – even before the war in Ukraine started.

Earlier studies and assumptions in the three scenarios

Earlier studies

While most studies that analyze the economic impact of climate change, carbon taxes, and other regulatory measures regarding the energy transition rely on general equilibrium models, some event studies try to quantify the empirical impact of isolated measures that have been implemented in one or more countries. Different models and different assumptions obviously lead to a wide array of results. Indeed, most equilibrium models find, for example, that carbon taxation will lead to moderate GDP declines over the long term. However, empirical studies typically find small-to-moderate positive effects of carbon taxes on GDP. In Table 1 we summarize the findings of various academic, official and financial industry research on (1) the implementation of carbon taxes; (2) the impact of climate change on inflation and (3) aggregate studies that attempt to quantify the impact on inflation of achieving net zero.

1. EU Commission Staff working document, Impact Assessment, Stepping Up Europe's 2030 Climate ambition, September 2022.
2. World Energy Outlook 2021, IEA, October 2021.

Table 1: Literature review

Authors study	Year	Findings
Faccia, Parker and Stracca	2021	Moderate to small short-term positive impact on inflation due to rising temperatures for EM and DM countries. In the medium term the authors find a small to moderate disinflationary effect.
Bylund and Jonsson	2021	A moderate impact of a roughly 0.2% increase in inflation by 2050 due to climate change is found. In case of broad adoption of a carbon tax of USD 200/ton (in 2019 prices) inflation is seen to deviate by 1.1% per year until 2033 before leveling off. By 2050 the effects of the carbon tax are seen to be deflationary with annual effects of -0.3%.
McKibbin, Konradt and di Mauro	2021	Inflationary effects of carbon taxes implemented in the eurozone should be contained. Assumes carbon tax of EUR 50/ton with 3% annual growth rate. A significant increase in headline CPI of about 1% is found only in the first two years following implementation. Impact on core inflation was found to be negative.
Struyven, Zhestkova, Hatzius, Bhushan and Milo	2022	Very small impact for Germany headline and core CPI of around 0.06% and 0.03% respectively is found. Assumes growth path of current carbon taxes per country to a rate of USD 100/ton in 2050 (in 2021 prices).
Dumitru, Kolbl and Ryszka	2020	Carbon taxes implemented at the country level or adopted at the regional level (EU) will lead to lower real GDP compared to baseline trend growth for all EU countries (-1% to -9% depending on the country). Analyis based on carbon taxes of EUR 100 and EUR 150 with the latter taxation leading to even worse economic outcomes.
European Commision	2020	European Commission analysis suggests that a full implementation of an EU-wide carbon tax of EUR 60/ton will lead to a small positive impact of 0.1% per year on inflation till 2030. Equally estimates growth impact to be negative by 0.24% versus the baseline scenario (stated policies only).
Moessner	2022	Empirical study showing that countries which have implemented a carbon tax generally see a 0.1% increase in headline inflation per USD 10/ton increase in carbon taxes.
Yoshino, Rasoulinezhad and Taghizadeh-Hesary	2021	Find relative large one-off impact on Japan headline CPI of 0.7% in case of a carbon tax adoption of 10% of energy prices. Further analysis shows that inflation is rather insensitive to changes in the carbon tax after implementation.
Andersson	2018	Study that aims to model maximum effects of implemetation of a global carbon tax implemented under different assumptions (USD 100 tax globally and USD 100 tax price level adjusted per country). Finds relatively large impact on headline inflation of 1% to 3% for developed economies and 7% to 8% for emerging economies.

It becomes clear that carbon taxes or regulatory measures aiming for net zero are generally expected to lead to higher consumer price levels and lower real GDP during the transition. That said, most studies only report a minor or very minor effect on both. However, general equilibrium models often assume a steady world with stable geopolitical relations and economic conditions, or that any carbon tax revenues will exclusively be used to lower other tax such as income tax or fund large green investment programs. Equally, empirical analysis of actual real-life carbon taxes from Sweden and Finland showing limited impact on inflation and growth should not be seen as a rule of thumb, as many of these carbon taxes entailed large exemptions for industry and power generation.

Three scenarios

In order to comprehensively assess the possible impact of the energy transition on inflation in the EU we have defined three main scenarios, as introduced earlier. The policy assumptions in each scenario are specified below:

1. **'Status quo' scenario.** This scenario assumes a continuation of existing or stated policies aimed at reducing GHG emissions by 55% in 2030 compared to 1990 levels. These policies mainly target power generation, industrial activities and aviation. Of the three scenarios, this one makes the least progress towards reaching net zero by 2050.
2. **'Carbon taxation' scenario.** This scenario assumes the implementation or further implementation of carbon taxes as the main policy tool for reducing GHG emissions. These would be aimed at a broader range of sectors, including power generation, industrial activities, aviation, road transport and building. While the EU sees this as a separate policy pathway, the IEA has carbon taxes as part of its 'Net Zero by 2050' policy scenario. Here we assume an expected carbon tax of USD 100 per ton of CO_2, which is in line with most studies, but exceeds the EUR 60 which is used in EU calculations. We presume that carbon tax revenues would be recycled back into the economy (around 50% through public investment in mainly renewable energy, and 50%

to support vulnerable households, to lower taxes on income or wages and to repay public debt).

3. **'Regulatory rush' scenario.** In this scenario, regulation rather than pricing is used as the main policy lever. Policy is aimed at a forced scaling down of specific carbon-intensive activities or adoption of low-carbon energy or policies. It goes even further than the EU's REG scenario and out of our three scenarios is expected to result in the most progress towards reaching net zero. This is also the most disruptive scenario.

Expected inflationary impact in the three scenarios

In Table 2 we assess the expected inflationary implications for the EU in the three policy scenarios, using the three channels identified by Schnabel (March 2022) – climateflation, fossilflation and greenflation. Note that the assessment focuses on the energy transition phase up to 2050 and does not capture any potential subsequent disinflationary effect. The pluses represent the expected magnitude of the upward impact on inflation on a 0 to 5 scale.

Table 2: Impact on EU inflation during energy transition in three main scenarios

	Climateflation	Fossilflation	Greenflation	**Overall**
1. Status quo	+++++	++++++	+++++	+++++
2. Carbon taxation	+++++	+++++	++++++	+++++
3. Regulatory rush	+++++	++++++	+++++	++++++

Note: Scale is from 0 to 5 (i.e. most inflationary). Gains after transition are not assessed here.

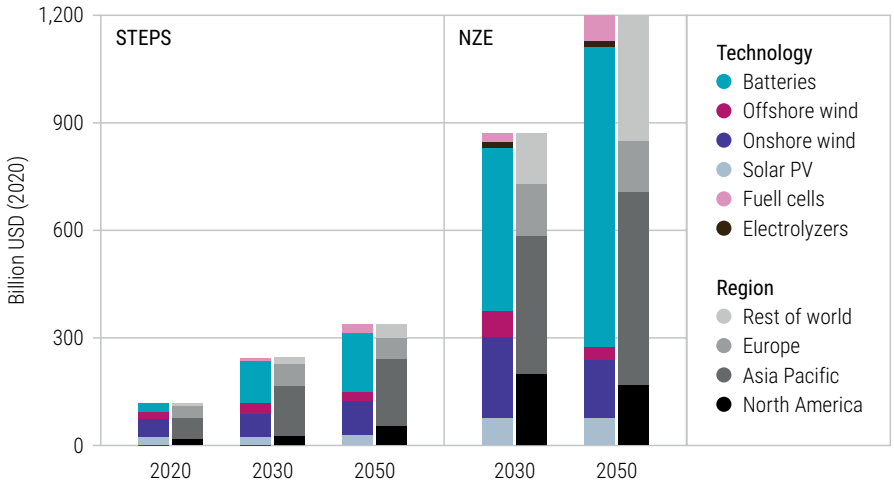
We regard the 'status quo' scenario as the least effective of the three in moderating the effects of climate change, as strongly evidenced by the impact studies conducted by the EU and IEA . As a result we expect the largest impact from climateflation to materialize in this scenario, with the demand for fossil energy remaining at a relatively high level while capex in the fossil energy sector is already constrained and the supply of renewable energy growing at a relatively modest pace. Hence, in this scenario we foresee sizeable fossilflation, with a more gradual pace of investment in renewables keeping greenflation limited.

The expected impact under the 'carbon taxation' scenario depends strongly on the way this policy is implemented. The effects as described in Table 2 assume that a substantial part of the revenues generated by carbon taxes will be used to subsidize investments in renewables. The rest will be transferred back to households, for instance via lower income tax. The net negative impact on household disposable incomes, in combination with the quicker availability of sufficient renewable energy, should lead to somewhat more modest fossilflation (albeit still notable as suppliers of fossil energy further scale back investment). Greenflation is expected to be higher in this scenario, though, as the increase in dedicated finance should accelerate investment in renewable energy sources, pushing up prices of critical inputs for green technologies more rapidly.

The 'regulatory rush' scenario is the most ambitious but also most disruptive scenario. It would probably result in the lowest inflation related to climate change itself, climateflation, although this would also depend on actions taken outside the EU. But the transitional inflationary impact from fossilflation and greenflation is likely to be substantial. In terms of fossilflation, we would expect a forced reduction in demand to have substantial negative consequences for capex in this sector, which could increase the scarcity of supply during the transition phase. Ultimately this would be matched with more capex and

energy supply from renewable sources (please see Figure 1 for what the composition of green technologies could look like), but there will potentially be a substantial mismatch between energy demand and supply in the transition phase. Also note that, as assumed by the IEA in their Net Zero scenario (see Table 3), after the transition fossil fuel prices are likely to be low. We expect the EU to adopt a mixture of the 'carbon taxation' and 'regulatory rush' scenarios and hence we expect fossilflation and greenflation to have a substantial effect on inflation during the transition phase. As far as the US goes, we think it is less likely that they will adopt a carbon tax or implement severe regulatory measures so in their case the biggest impact will come from fossilflation.

Figure 1: Projected market size of selected green technologies in IEA Stated-Policies and net-zero emissions by 2050 scenarios



Source: IEA (World Energy Outlook 2021, page 30)

Table 3: Assumed fossil fuel prices in IEA scenarios

			Net-zero emissions by 2050		Sustainable development		Announced pledges		Stated policies	
Real terms (USD/2020)	2010	2020	2030	2050	2030	2050	2030	2050	2030	2050
IEA crude oil (USD/barrel)	92	42	36	24	56	50	67	64	77	88
Natural gas (USD/MBtu)										
United States	5.2	2.0	1.9	2.0	1.9	2.0	3.1	2.0	3.6	4.3
European Union	8.8	4.2	3.9	3.6	4.2	4.5	6.5	6.5	7.7	8.3
China	7.9	6.3	5.3	4.7	6.3	6.3	8.5	8.1	8.6	8.9
Japan	13.0	7.9	4.4	4.2	5.4	5.3	7.6	6.8	8.5	8.9
Steam coal (USD/tonne)										
United States	60	43	24	22	24	22	25	25	39	38
European Union	109	50	52	44	58	55	66	56	67	63
China	127	69	58	50	67	63	73	63	77	70
Japan	137	89	61	51	72	66	77	65	83	74

Source: IEA (World Energy Outlook 2021, page 101)

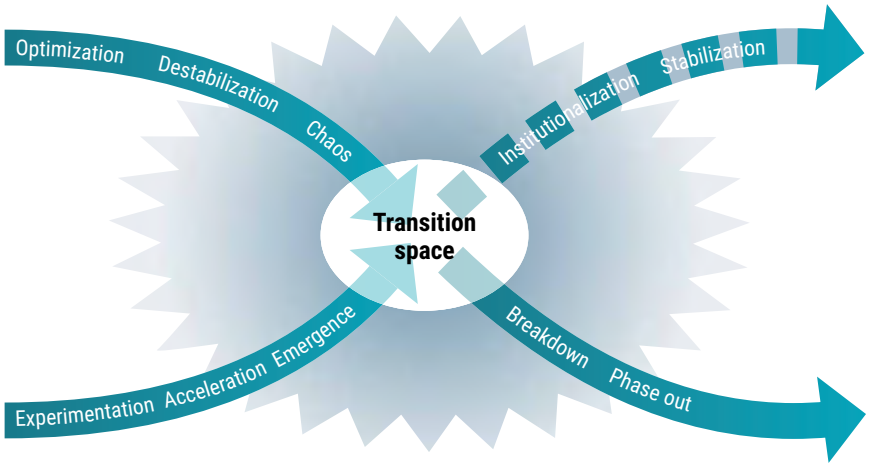
In terms of how our more qualitative assessment stacks up against the inflation effects estimated in the studies we highlighted earlier, we argue that our findings come closest to the findings of Andersson (2018) and Bylund and Jonsson (2021) – i.e. sizable transitional inflationary effects. In the latter study it is also assumed that the recycling of carbon tax revenues back into the economy will indirectly also have a positive effect on inflation via demand (on top of the increase in energy costs). This echoes comments from the ECB's Schnabel that "to the extent that carbon tax revenues are used to cut social security contributions or the labor tax wedge, a carbon tax may boost economic activity, even in the short term".[3]

Comparing our assessment with the simulations in the EU scenarios, which merely assume an EU-wide carbon tax of EUR 60 ton of CO_2 while showing only a minor positive impact of 0.1% per year on inflation until 2030, our scenarios are clearly less upbeat. In particular, we believe the transition will not go as smoothly as is implicitly assumed (see the experience in Germany and other EU countries in 2021). Or put more positively, in the words of Schnabel, "The faster the shift to a greener economy becomes, the more expensive it may get in the short run".[4] Conceptually, we think the framework of Loorbach et al (2017) is a good guide on how transitions often work (Figure 2).

3. https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220108~0425a24eb7.en.html

4. https://www.ecb.europa.eu/press/key/date/2022/html/ecb.sp220317_2~dbb3582f0a.en.html

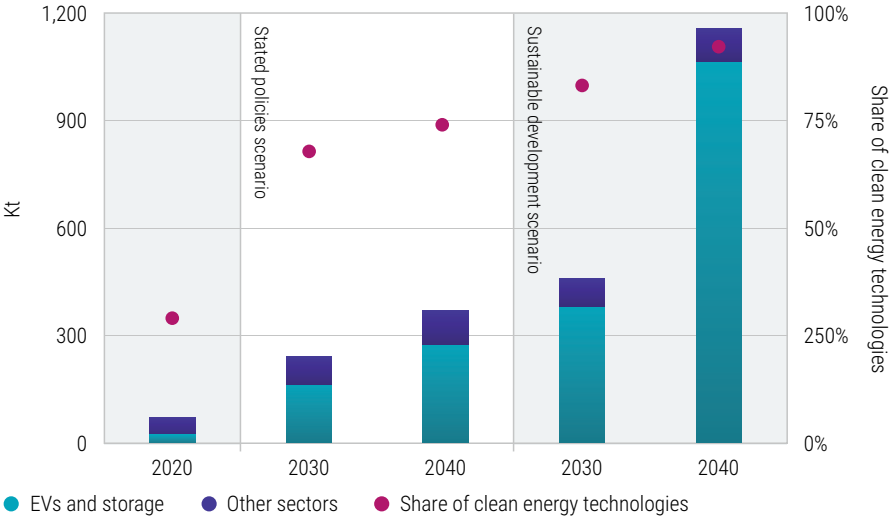
Figure 2: Transitions



Source: Loorbach et al. (2017)

Transitions are very complex processes. Their outcome is the result of various powerful forces, including chaos and stabilization, coming together in often unpredictable ways. In the context of the energy transition, we highlight that implementation of carbon taxes or a strong regulatory push towards renewables in a perhaps too tight a time frame is very likely leading to all sorts of adaptive behavior. Oil producers, for example, are cutting capex as they now have an incentive to keep oil prices high. Equally, lithium prices are highly elevated as the rush toward electric vehicles is pushing demand well above supply, as shown in Figure 3. The many other examples of disruption include limitations on our power grids and extreme shortages in technically skilled labor, which will cause disorder for some years to come. Disruptions like this are wide-ranging and likely to stay with us for some time, keeping upward pressure on commodities and inputs for renewables.

Figure 3: Lithium demand



Source: IEA[5]

5. https://www.iea.org/data-and-statistics/charts/total-lithium-demand-by-sector-and-scenario-2020-2040

Finally we should note that as for the three identified sources of inflation – climateflation, fossilflation, and greenflation, the first two mainly affect energy and food price inflation – while the latter also has implications for goods price inflation. However, the overall effect on inflation will also include the spillovers into other CPI categories, such as travel and restaurants.

Conclusion

Although the energy transition has crucial long-term benefits, these will come at a cost. The smooth transition pathways depicted, for example, in the EU Staff's Impact Assessment do not seem very realistic, as the experience of the past two years has illustrated. This underlines that public and political support for transition policies is not always a given and requires strategic policymaking. Our analysis shows that the way in which governments shape this process can have an important influence on the inflationary implications and hence the public support and fossil-fuel backsliding risks during the transition.

The expected inflationary impact will probably be highest in the 'regulatory rush' scenario, where we foresee a sizeable mismatch between energy demand and supply. We expect smaller and roughly similar inflationary consequences in the 'status quo' and 'carbon taxation' scenarios, but with a different composition. The former will likely have higher inflationary pressures from fossilflation and less from greenflation, while the latter is expected to have higher greenflation but less fossilflation. This distinction matters not only for fiscal policies geared towards supporting vulnerable households, which will feel a higher impact from fossilflation, but probably also for monetary policy. While climateflation and fossilflation will primarily be seen as adverse supply shocks, greenflation could be regarded as a sign of demand strength. This suggests monetary policy will likely be most responsive in the 'regulatory rush' scenario, where greenflation is highest. However, in all three scenarios central banks will be keen to ensure that medium- to longer-term inflation expectations remain anchored to their inflation target. Investors would be well-advised to brace themselves for a more volatile inflation – and interest rate – backdrop. ●

SPECIAL TOPIC | FOOD SECURITY

(No) food for thought

Rising food insecurity[1] is likely to be one of the key factors driving the volatility of emerging financial markets over the next three to five years. Drivers and relationships that cause food insecurity are complex and range from conflict and political insecurity to weather extremes and economic shocks. Food prices are an integral part of the puzzle, and when these rise they provide a significant inflationary push, especially in emerging markets. They also negatively impact global growth, and have been shown to precipitate acute social unrest.

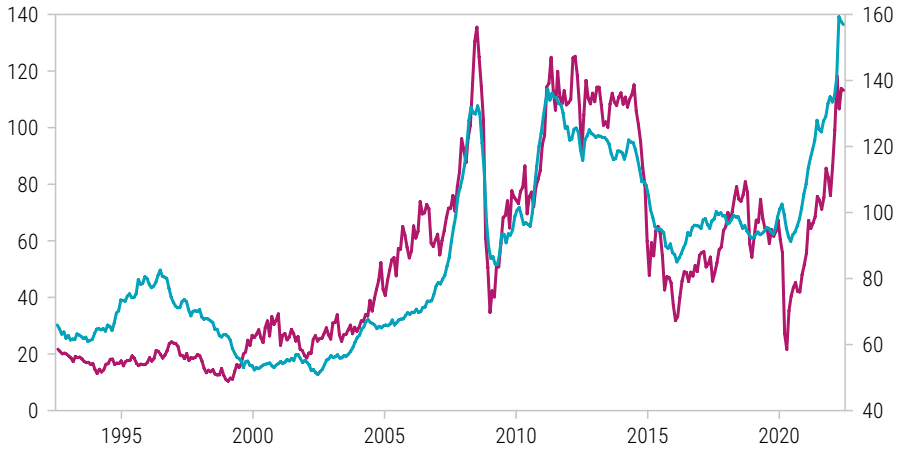
For a multi-asset investor, therefore, monitoring food prices is key. With the Food and Agriculture Organization's Food Price Index (FFPI) having risen by 67% since the start of the Covid pandemic, it is also essential to understand the wider impact of food prices on commodities, the relationship with climate change, and the corresponding possible government responses and political instability. This can provide investors with a deeper insight into market volatility as well as identify opportunities that emerge from companies looking for solutions.

1. According to FAO, "Food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". This means that safe and nutritious food has to be affordable and physically available at all times to everyone who needs it, as formulated in SDG 2: Zero Hunger.

What's driving the current rise in food prices

Underlying factors behind the current rise in food prices are many and varied. Triggered by pandemic hoarding, the rise was exacerbated by a relatively poor harvest season in 2020 and travel restrictions leading to a shortage of foreign workers in key production areas.[2] Post-pandemic recovery then drove up oil and gas prices, which are correlated with the prices of agricultural raw materials (Figure 1). Moreover, while a shortage of natural gas is often thought of as a heating problem, 25% of global supply is actually used in fertilizer manufacturing. Fertilizer typically accounts for 15-20% of crop production costs[3] so producing food has rapidly become more expensive, with the world food import bill reaching a historic high in 2021.[4]

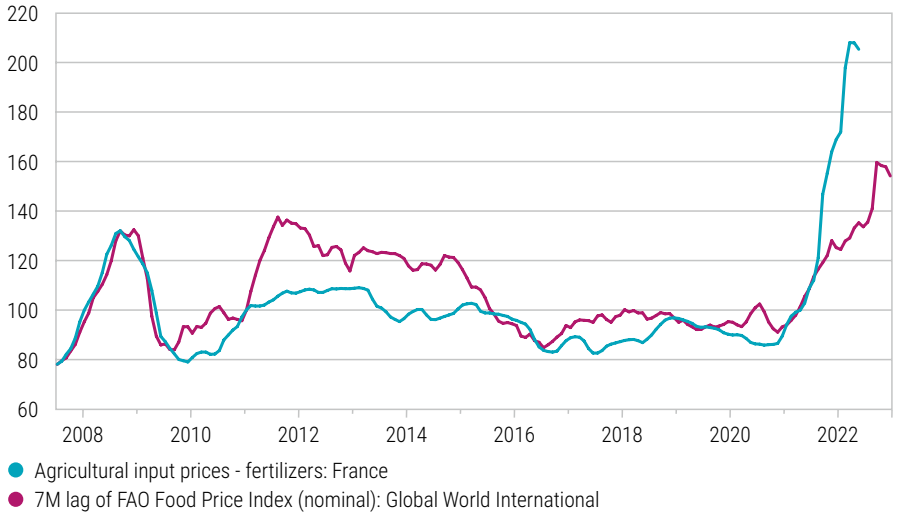
Figure 1: Covariation of oil and food prices



Source: Refinitiv Datastream, Robeco

In addition, Russia's invasion of Ukraine has severely affected the food and fertilizer export capacity of both countries, who are major players in this field, creating a perfect storm for further, exponential price increases (Figure 2). Worried about future shortages, several countries including China have begun rebuilding their food reserves, limiting the supply to the market and creating a vicious circle of further price increases.

Figure 2: FFPI versus fertilizer prices



Source: Refinitiv Datastream, Robeco

2. https://www.nst.com.my/business/2021/12/756269/labour-shortage-may-drag#:~:text=By%20the%20end%20of%20September,in%20Malaysia%20is%20over%2032%2C000.%22

3. United Nations Statistical Commission. "Agricultural Cost of Production Statistics: Guidelines for Data Collection, Compilation and Dissemination." Global Strategy (2016).

4. https://news.un.org/en/story/2021/11/1105552

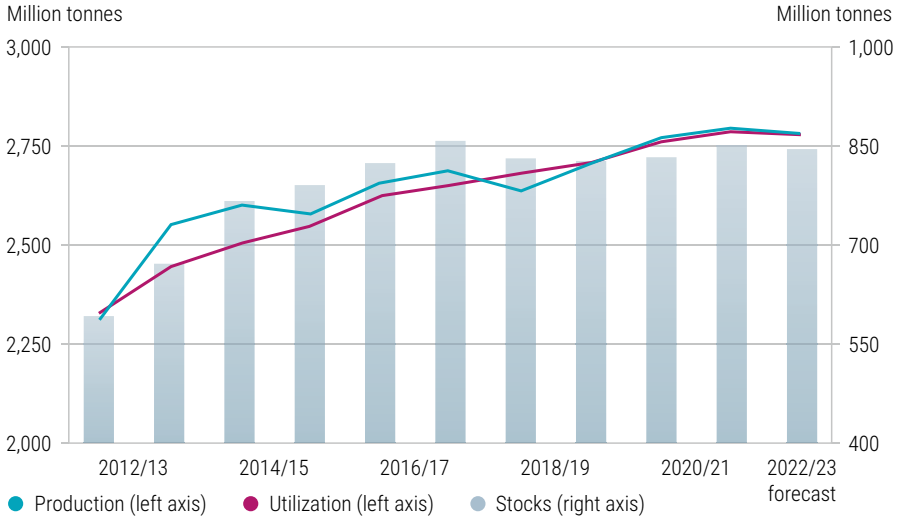
The level of direct exposure varies between commodities and their buyers

Rising prices affect commodity markets and prices of raw materials for many industries, but the speed and magnitude of this impact will vary. Soybean production does not require the addition of nitrogen-based fertilizer, which means the price of this commodity and subsequently animal feed did not rise that much initially.

Since the 2010 spike in global food prices, world grain reserves have increased (Figure 3). This eased some of the initial inflationary pressure on wheat and corn prices. The same cannot be said, however, for the oil crops, prices of which have been rising exponentially since the end of 2021 until they corrected in February 2022 (Figure 4). With Ukraine normally supplying half of the world's sunflower oil, and Russia a further 25%, the war has exacerbated the situation significantly.

The price of palm oil is correlated with sunflower oil and crude oil as these are substitutes in the biodiesel production process. Amid food security concerns, in May 2022 Indonesia, the world's biggest exporter of palm oil, temporarily banned all exports of this commodity. The large increases in other oil crops spilled over to soybean. The subsequent reversal of the palm oil ban provided some relief to the rising price of vegetable oils.

Figure 3: Cereal production, utilization, and stocks

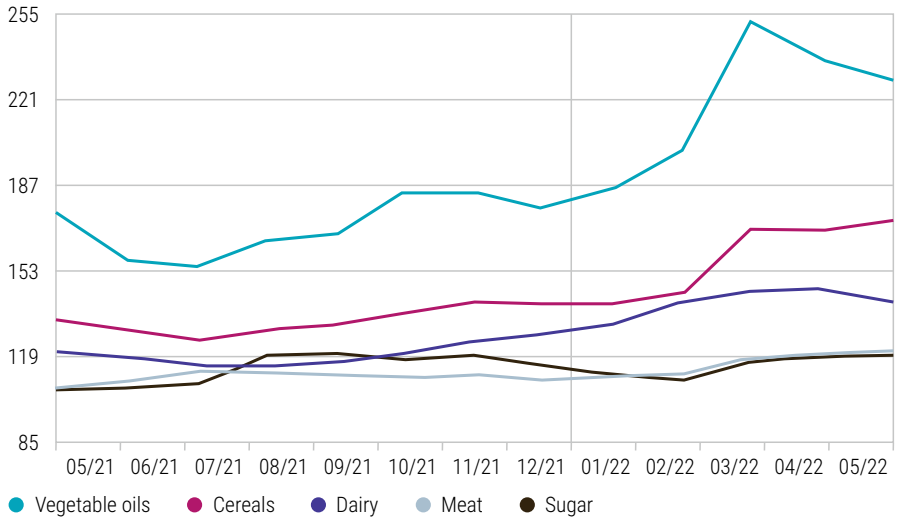


Source: FAO (2022)

The quality of 2022's northern hemisphere harvesting season will further affect prices. Weather patterns and subsequently crop yields have been increasingly unpredictable in recent years due to climate change. India has experienced record heat waves in the spring, resulting in crop failure and wheat export restrictions. A particularly dry, wet or windy summer season in the French Beauce region or the US Corn Belt could also complicate the harvest, putting further pressure on prices. The hot, dry summer in 2018 led to a drop in cereal stocks (see Figure 3) and a rise in price not seen since 2008.

Figure 4: FAO Food Commodity Price Indices

2014-2016=100



Source: FAO (2022)

Knock-on effects may be felt for a while

Some of the current drivers behind rising food prices may ease off in the short term, depending on how the situation in Ukraine develops and how willing governments are to tap into grain reserves. However, the mean reversion across the market could take longer. When fertilizers are expensive, cash-squeezed farmers reduce their use, resulting in reduced crop yields for several seasons to come. Suboptimal fertilizer use increases the vulnerability of agricultural systems to shocks such as floods and droughts. A recent study conducted by Robeco and the Cambridge Institute for Sustainability Leadership showed that farmers operating on degraded soil see their market value decline more in the event of a shock, while those with healthy soil see their market price increase.[5] Finally, when feedstuff is expensive, livestock producers tend to scale down investments in restocking, reducing the supply of meat and causing further meat price increases.

The case for more sustainable agricultural practices

For some, organic farming is a particularly appealing investment proposition right now because organic farmers do not use any synthetic fertilizers or pesticides, and therefore their production should be less susceptible to fluctuations in the price of oil or natural gas. Given the fact that organic produce sells at a premium, organic farming in its current form is already cost-competitive with conventional agriculture.[6] This shows consumer willingness to pay for practices perceived as more sustainable.

However, with organic farming accounting for just 1 to 2% of crop production area globally, there are scalability challenges. Organic farmers rely on organic fertilizers, mainly in the form of cattle manure, and the availability of this input is limited. The production of synthetic fertilizers can be adjusted though, as demonstrated with the renewed interest in Canadian potash.[7] In reaction to rising fertilizer prices, organic farmers in the US are already experiencing manure shortages as more conventional farmers are looking for alternatives to replenish their nutrient supplies.[8] The EAT-Lancet Commission, in the drive to meet the UN SDGs, strongly recommends a shift to more a more healthy, sustainable and plant-based diet in the future.[9] The decrease in animal protein consumption will mean fewer farm animals and less manure, further limiting the availability of nutrients.

Finally, organic farming is typically associated with lower temporal yield stability (on average 15%), compared to conventional agriculture.[10] But while organic farming alone

5. https://www.cisl.cam.ac.uk/news/new-report-highlights-how-vulnerability-degraded-soil-extreme-weather-can-deliver
6. https://www.pnas.org/doi/10.1073/pnas.1423674112
7. https://www.bloomberg.com/news/articles/2022-05-02/fertilizer-buyers-eyeing-canada-to-fill-global-potash-deficit
8. https://www.reuters.com/world/us/us-manure-is-hot-commodity-amid-commercial-fertilizer-shortage-2022-04-06/
9. https://eatforum.org/eat-lancet-commission/eat-lancet-commission-summary-report/
10. https://www.nature.com/articles/s41467-018-05956-1

does not seem to be the solution, there is a case for practices that integrate elements of conventional and organic agriculture to design more sustainable but also productive systems. Some of these practices are recently being loosely referred to as 'regenerative farming'. An increasing number of corporates are becoming increasingly vocal about supporting regenerative agriculture, in particular its ability to restore and protect nature and biodiversity, but actual activities and control mechanisms remain unclear. We expect that the companies who are more advanced along this journey, especially those with vertically integrated supply chains, to be better able to weather the upcoming pricing storm.

The emphasis on 'productive' is important. Crop yields are inversely correlated with carbon footprint.[11] Due to lower productivity, a total switch from grain-based to grass-fed beef in the US would require an additional 23 million cows. It would also require a 370% expansion of current grassland acreage, reaching 535 million hectares, half of the total area of Canada.[12]

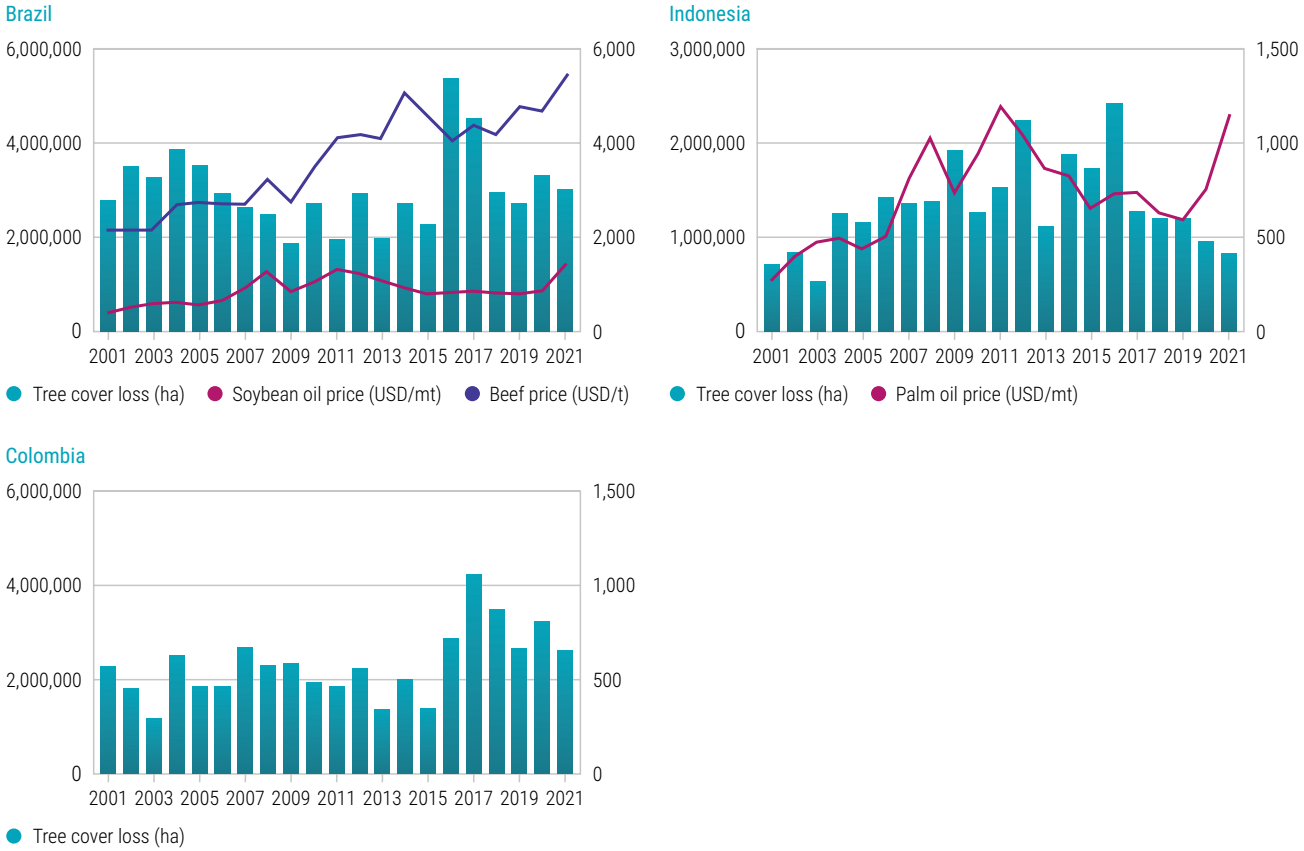
11. https://www.sciencedirect.com/science/article/pii/S0959652621023398

12. https://iopscience.iop.org/article/10.1088/1748-9326/aad401

Food prices and deforestation

Some investors are concerned that current high prices will further accelerate deforestation and exacerbate the climate and biodiversity crises. High prices are a result of buying activity and therefore an indicator of rising demand, in this case for certain soft commodities, especially beef, soybean, oil palm, and cocoa. This is commonly touted to be the main driver behind global deforestation. However, the empirical data does not appear to support this. The tree cover loss in Indonesia has been dropping in recent years, in spite of continuously rising demand and skyrocketing prices of palm fruit bunches (Figure 5). And despite a clear link between cattle ranching, soy and deforestation, Brazilian deforestation rates are rising, but following neither the evolution of soybean nor beef prices.

Figure 5: Commodity prices and deforestation rates



Source: World Bank Commodity Price Data (The Pink Sheet), updated June 2022, World Resources Institute

Governance and institutions, especially at the local level, are more important drivers of deforestation than price signals – both in terms of combating and accelerating it.[13] The relationship between the strength of institutions and deforestation rates is complex and non-linear. In Colombia, the rate of deforestation has increased following a 2016 peace agreement between the government and the Revolutionary Armed Forces of Colombia (FARC), as loggers and miners moved into previously inaccessible regions.[14]

13. https://www.pnas.org/doi/10.1073/pnas.1610650114

14. https://www.nature.com/articles/d41586-018-05397-2

Food insecurity often leads to more political instability, more regulation, and more debt

Food insecurity can result from conflict, social and economic inequality, poverty and climate change, to name just a few causes. But rising food insecurity has also been linked to numerous protest movements throughout history, including the French revolution. In 2012, researchers from the New England Complex Systems Institute in Cambridge published a famous report suggesting a relationship between the FFPI[15] and protest movements. With the last most severe price spike in 2010 correlating with the Arab Spring and the start of the Syrian war, the authors claim the existence of a "specific food price threshold above which protests become likely".

15. Karla Z. Bertrand, Greg Lindsay, and Yaneer Bar-Yam, Food briefing, New England Complex Systems Institute Report 2012-09-28.

The FFPI has now been rising since the start of the Covid pandemic, reaching record highs in March 2022. If this trend persists, social unrest on a global level may ensue. It is in every government's interest to avoid such crises and to keep food security high on the agenda. A hungry population leads to angry voters or potentially insurgency and regime changes. This is one of the reasons why we believe governments are bigger drivers of change than corporates.

Rising food prices are therefore usually coupled with bold policies designed to keep the situation under control. Typical measures include setting price ceilings (bad news for the earnings of food producers), investing in building reserves up again, offering tax cuts for foods, implementing trade barriers, and offering subsidies (Figure 6). All of these instruments are expensive and will provide headwinds to global, but especially emerging market growth. They will further stretch national budgets and affect current account balances, leading to countries taking on more debt at higher yield spreads. Activist fiscal policy translates into higher inflation volatility and this will subsequently have a negative impact on growth.[16] Slowing growth will depreciate emerging markets' currencies, in some cases slowed down by rising interest rates.

16. Rother, P., "Fiscal policy and inflation volatility". Available at SSRN 515081 (2004).

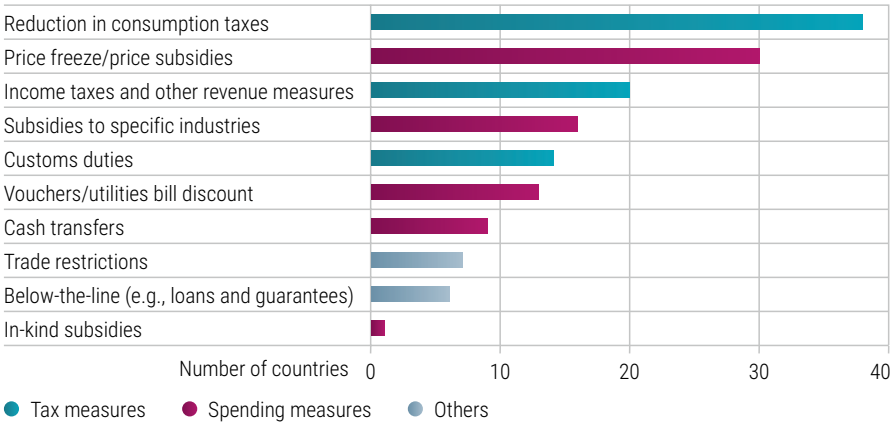
What policies can be useful?

Around 40% of US corn is currently used for biofuels. The World Resources Institute estimates* that if the US and Europe reduced grain used for ethanol by half, it would compensate for all the lost exports of Ukrainian wheat, corn, barley, and rye.

Another 45-50% of US corn is used as animal feed. In the majority of the world (except sub-Saharan Africa), reducing the production and consumption of red meat would help to improve both public health and environmental outcomes. Ruminant animals (cows, goats, sheep) require vast amounts of land and inputs per calorie produced and contribute to climate change through methane emissions. Governments can incentivize more sustainable consumption through subsidies for fruit and vegetables and taxes on red meat. Studies showed that such policies would result in a net positive effect on a country's fiscal balances, as better diets also lead to lower healthcare costs. In the next three to five years, policymakers are not likely to be bold enough to introduce taxes on food (even just meat), but subsidies for vegetables along with information campaigns could have some of the desired effect.

* https://www.wri.org/insights/ukraine-food-security-climate-change

Figure 6: IMF energy and food policies survey



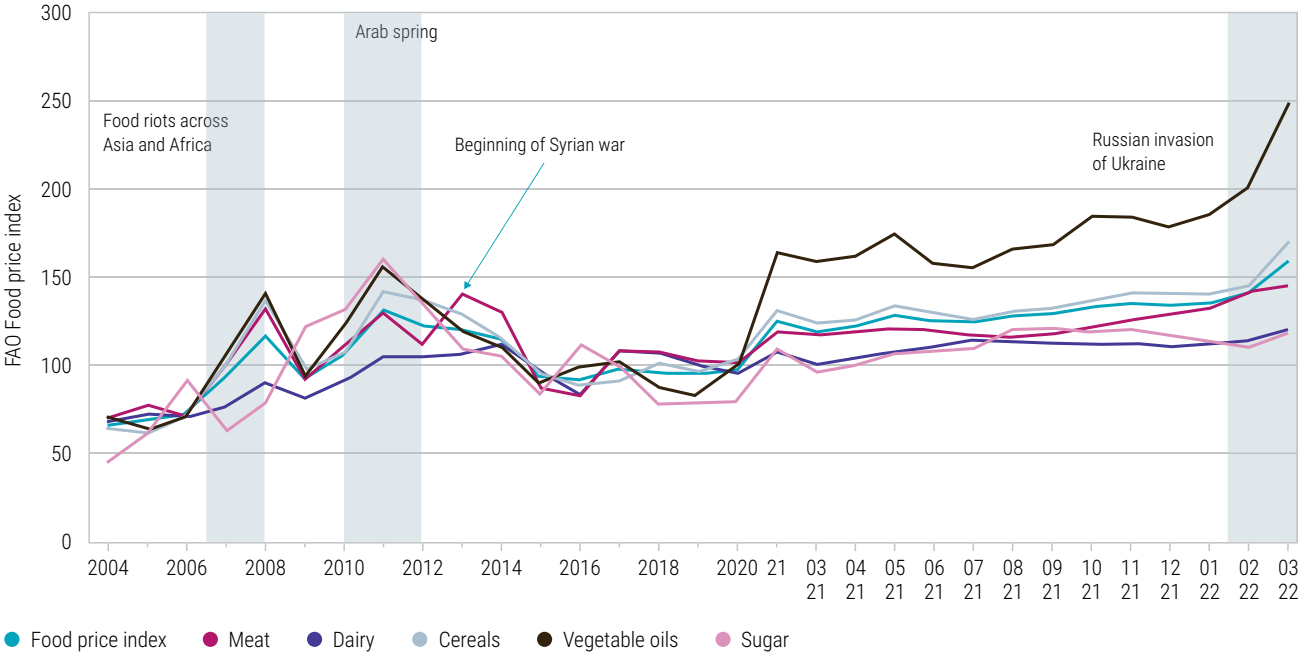
Source: IMF desk survey based on inputs for 134 countries (responses received as of 31 March 2022).
Note: This graphic includes measures announced after 1 January 2022.

For fragile states with pre-existing problems that won't or can't afford to maintain relative price stability, large political shifts are likely. The disintegration of Syria, the Arab Spring, and Europe's refugee crisis are commonly linked to food price spikes in 2007 and 2010 and we are now at the beginning of another, more profound rise (Figure 7). Unless food aid programs are rapidly deployed, famine is also likely across the most vulnerable regions of the world, particularly in the Horn of Africa which is seeing its driest rainy season on record, putting 20 million people in acute food insecurity.[17]

17. https://reliefweb.int/report/ethiopia/horn-africa-drought-humanitarian-update-10-june-2022

Lack of food security will also most likely accelerate economic migration. This can have a positive impact on countries with relatively good GDP growth and aging populations but may lead to negative public sentiment in countries affected by the recession. This anti-immigration sentiment very often leads to the election of populists, who implement protectionist, suboptimal policies that provide further headwinds to growth.

Figure 7: Food prices and conflicts



Source: FAO (2022), Robeco

Who might be the winners?

As in the last price spike in 2010, we expect the current food crisis to provide a favorable environment for those who can provide solutions. In the face of the growing climate and biodiversity challenges, agricultural productivity needs to be increased in a sustainable manner. Conventional intensification methods based on increasing inputs of fertilizers and pesticides or the stocking density of animals cause significant environmental challenges. Organic farming on its own is not scalable. Those who invest in regenerative, productive agricultural practices are likely to get ahead. This includes such diverse enterprises as agricultural equipment producers that allow efficient distribution of water, nutrients or pest control with minimum inputs from pesticides; chemical companies that provide solutions for improving the efficiency of animal feeding, and financial institutions that provide affordable loans to farmers in need.

Differences in resilience across equities and corporate bonds

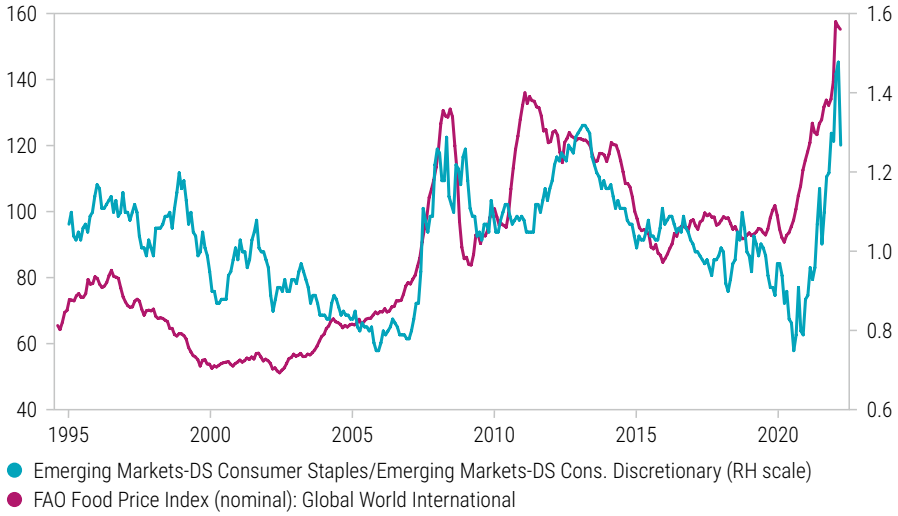
The consequences of rising commodity prices are already being felt. These are squeezing margins of food, bio-fuel, and bio-based chemical manufacturers, consumer goods companies, and pharmaceuticals. Companies with long-term hedging contracts will initially absorb those price increases better, but these will eventually catch up with them as contracts expire. Strong consumer staples brands are better able to pass some of the costs on to the consumer, but as consumer budgets are squeezed, people will switch to cheaper alternatives or reduce the use of products altogether.

The degree to which consumer confidence will be affected by rising food prices varies widely between markets and consumer groups within markets. On average, food consumption in emerging markets amounts to 25% of overall consumption, whereas in developed markets this is typically around 10%. For example, consumers in the US spend on average as little as 6% of their income on food, while this constitutes over 50% in Nigeria.

These significant differences between countries are not necessarily directly related to the level of income but also to geographical factors. Consumers in Brazil spend only 16% of their income on food, while this constitutes 30% in Romania.[18] Within countries, too, the differences can be substantial. The poorest 20% of US households spent 28.8% to 42.6% of their budgets on food over the last 25 years, while the wealthiest 20% only spent between 6.5% and 9.2%. The increased spending on basic food over the next few years will substantially reduce the demand for discretionary products and services for low and middle-income consumers. This substitution effect is reflected by the strong correlation between the relative performance of emerging market discretionary goods corporates versus their consumer staples counterparts and the FFPI. Rising food prices favor an equity allocation towards the staples sector over the discretionary goods sector (see Figure 8).

18. Our World in Data, Share of consumer expenditure spent on food, 2016 based on United States Department of Agriculture (USDA) Economic Research Service.

Figure 8: Food prices and relative sector performance

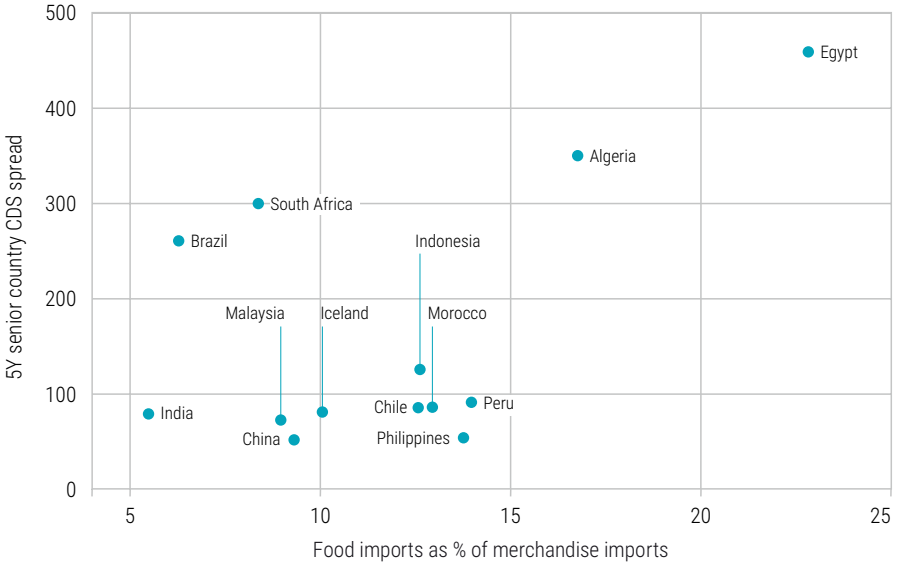


Source: Refinitiv Datastream, Robeco

Companies operating in the discretionary goods segments are likely to see a drop in revenues, especially in countries depending on food imports and with significant shares of income spent on food. Fast food restaurants and food delivery services in those countries will be affected by increased input costs and reduced demand. This will also be the case for some branded consumer staples with significant exposure to these markets, especially those purchasing significant amounts of vegetable oil.

The options governments have at their disposal to mitigate potential food crises as discussed earlier are costly, as they drive up fiscal deficit and thereby erode debt sustainability. In response, sovereign bond investors require higher compensation for taking sovereign credit risk in countries that are more vulnerable to food crises as proxied by the amount of food imports as a percentage of merchandise imports (Figure 9). Egypt and Algeria in particular are proving to be susceptible to a vicious spiral of food crises, raising the cost of debt to finance mitigating measures.

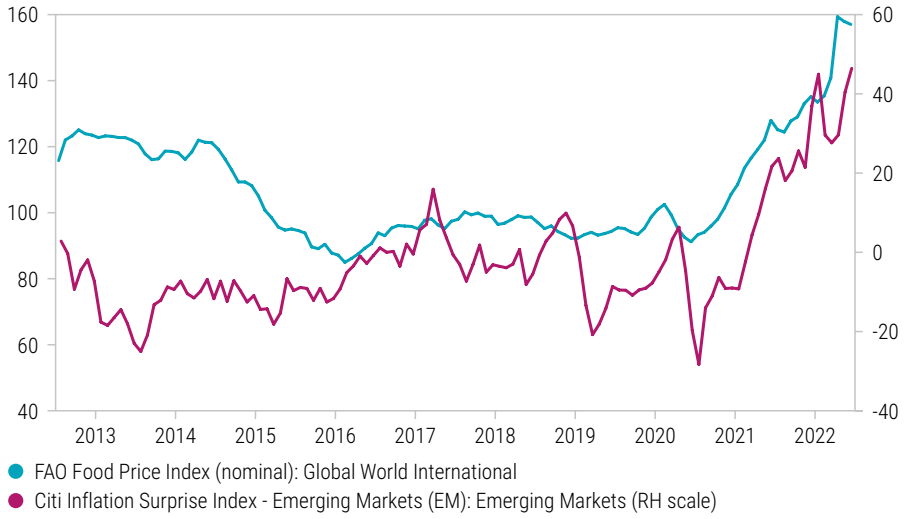
Figure 9: Food imports and 5Y sovereign CDS spreads



Source: Refinitiv Datastream, Robeco

For a multi-asset investor, monitoring food prices remains key as they provide a significant inflationary push, especially in emerging markets, given their weight in overall consumption. In reflection of this, the emerging market inflation surprise index (Figure 10) is very strongly correlated with the FFPI. Elevated food price inflation could therefore lead to international investors demanding higher compensation of inflation risk to invest in emerging market assets, and a more hawkish stance by emerging market central banks in order to contain inflation.

Figure 10: FAO Food Price vs EM inflation surprises

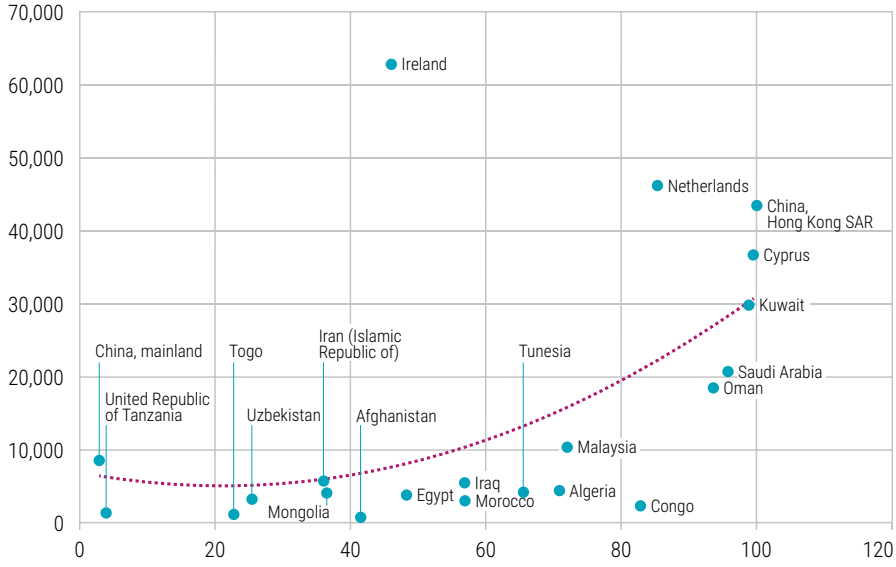


Source: Refinitiv Datastream, Robeco

Figure 11 shows the cereal import dependency ratio (which tells us how much a country imports cereals versus its domestic production)[19] versus the ability to pay for food (proxied by GDP per capita). We see that especially certain Arab League members are vulnerable to rising food prices, given their high import dependency and relatively low income per capita.

19. Cereal import dependency ratio = (cereal imports - cereal exports)/(cereal production + cereal imports -cereal exports) * 100

Figure 11: Cereal import dependency versus GDP per capita in USD (constant 2010 prices)



Source: Refinitiv Datastream, FAO, Robeco

Conclusion

Rising food insecurity is likely to be one of the key factors driving the volatility of emerging financial markets over the next three to five years. Low and middle-income consumer budgets will be increasingly squeezed, reducing the demand for discretionary products. We expect large inter- as well as intra-country variability of this effect, depending on the share of income spent on food, and also the share of imported food in countries' food balances. Rising raw material costs will provide several challenging earning seasons for consumer staples, as not all companies will be able to pass rising costs on to the increasingly budget-constrained consumer.

Governments are likely therefore to respond with policy interventions, many of which will result in more debt and less local and ultimately global growth. On the flip side, the world has significantly increased its grain stocks since 2008. The grain stock-to-utilization ratio is still well above the 2008 levels, creating a buffer for willing governments to ease some of the global pricing pressures. Policymakers can also make a difference by removing some of the biofuel subsidies. Improved food security as defined in the SDGs can only be achieved in the long term if we shift to a productive agricultural system that can support 9 to 10 billion people within the constraints of one planet. In this way we expect a renewed policymaker focus on sustainable intensification of agriculture and more sustainable and healthy diet trends, creating revenue opportunities for those who provide the solutions. ●

EXPECTED RETURNS 2023-2027

4. Macro

Are we going to see a major paradigm shift with regard to inflation in the next five years? Will the supply side of the economy improve enough to return developed economies to an above-trend growth trajectory? What might be the nature of the next recession? In our base case scenario, the hard landing that unstings inflation, we explore what the aftermath of a 2023 recession might look like. But what if the multiplicity of recent shocks ultimately has a silver lining for the global economy? In our bull case scenario, The Silver Twenties, we discuss the underpinnings of an upward level shift in real activity and benign disinflation. Finally, in our bear case scenario, The Stag Twenties, we tackle a question not currently being asked by consensus: what if the current global tightening cycle and the ensuing recession are not enough to stop stubborn inflation in its tracks?

Reading guide

In order to address these questions thoroughly, we first want to examine the various factors that have helped shape and inform our scenario thinking. Below, we first briefly summarize recent economic history. We then look at the increase in and reasons behind macroeconomic volatility and whether this really does signal a paradigm shift, as well as what disinflationary pathways might lie ahead. Finally, we explore our three scenarios in detail.

4.1 A new macro volatility regime

Is the era of Great Moderation ending? When the global economy emerged from a period of Great Inflation (1965 to 1982), it entered a period of relative macro stability with low inflation and anchored inflation expectations. In central banking, the debate on rules versus discretion came down in favor of a rules-based policy regime that showed time consistency, allowing the public to infer where monetary policy was heading; see Fischer (1988) and Taylor (1993). Finally, the peaking of the working age population growth rate in the late 1970s combined with these elements meant that long-term interest rates steadily declined during this period: an era of Great Moderation.

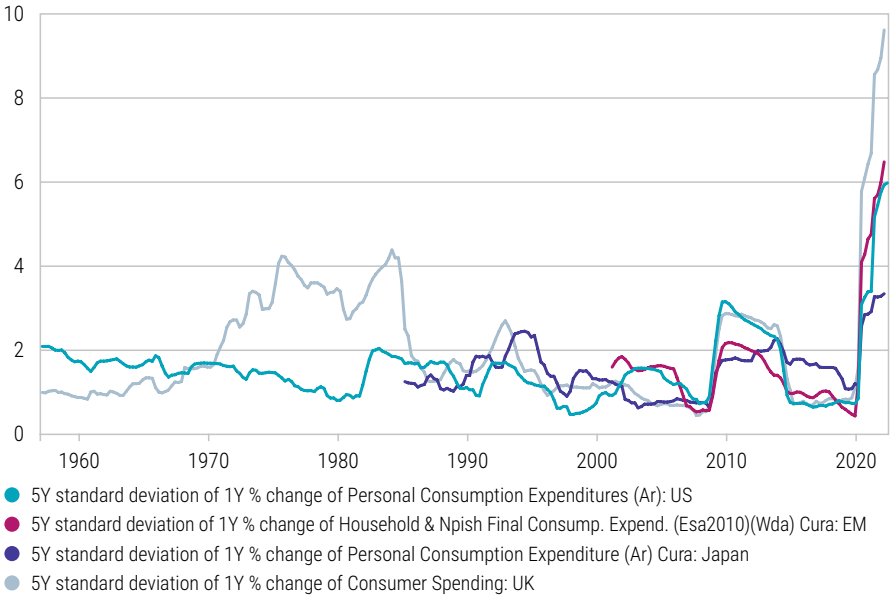
Back in the 1960s, macroeconomic volatility started to decline thanks to shifts in the economic structure. Service activity gradually became the dominant part of the pie, surpassing the more volatile manufacturing share of total added value in developed economies. Inventory volatility also declined thanks to the shift to 'just in time' . The broader adoption of the liberalist economic model represented by Reagan and Thatcher also increased the free flow of goods and capital, while increased openness and enhanced economic efficiency of developed economies reduced macroeconomic volatility as well.

But the tide is turning. The era of Great Moderation is becoming more strongly punctuated by the recent energy, food, climate and pandemic shocks. In such an environment, the quest for security is trending. For example, firms are shifting from just-in-time to just-in-case as security aspects start to compete with efficiency considerations in supply management and energy sourcing (see our special on globalization). The current focus on dual sourcing and precautionary stocking could enhance bullwhip effects in supply chains. In addition, the international flow of goods and capital (and the accompanying volatility suppressing technology spillovers) is slowing. Furthermore, the manufacturing share of global GDP already grinded higher post-global financial crisis, but has been reinvigorated by the overshoot in goods consumption during the pandemic. Looking ahead, defense spending will also be picking up as a percentage of GDP, while competition between superpowers will concentrate on high-end manufacturing. Lastly, in order to reach net-zero carbon commitments by 2050, massive investments are needed which will predominantly lean on manufacturing activity as well.[1]

1. The IEA (2021) finds that to reach net-zero emissions by 2050, global annual clean energy investment needs to more than triple to around USD 4 trillion.

In short, the more volatile parts of real activity are on the rise again. Moreover, service activity itself has become more volatile in the wake of the pandemic with the emergence of lockdowns. As a result, volatility in GDP and its components has surged and is expected to remain elevated. The recent skyrocketing of consumption volatility and ensuing level shift carries important implications for asset pricing and risk premiums (see Chapter 5).

Figure 4.1: A cross-regional surge in consumption volatility punctuating the Great Moderation



Source: Refinitiv Datastream, Robeco

4.2 Regime characterized by multiplicity and persistence of shocks

Indeed, nothing seems particularly moderate about today's macro climate. We are experiencing turbulent times as we are confronted with the highest US inflation as well as the lowest Chinese GDP growth of the past 40 years, record-low consumer confidence in the US and the eurozone, the Russian war in Ukraine, and an energy and food crisis. The largest global growth engine is sputtering as China tries to stabilize widening cracks in its economic stronghold over the past two decades, mainly in its real estate sector, while still battling Covid via lockdowns. Most importantly, the climate crisis, which was also the theme of our outlook last year, is more urgent than ever as heat waves blast the globe at the time of writing, affecting everything from public health to food prices to biodiversity.

Markets and central bankers have been surprised by both the multiplicity of shocks as well as their persistence. In last year's edition we presented a low-frequency uncertainty measure by Jurado et al (2015) that showed the highest value on record, exceeding the Volcker disinflation era and the global financial crisis, and noted that once uncertainty episodes appear in this metric they are large, highly correlated with real activity, and especially more persistent. Though central bankers have by now dropped the word 'transitory' from their verbal guidance when talking about inflation, they clearly underestimated the persistence of inflationary pressures and ended up behind the curve. At the June 2022 ECB conference, Fed president Powell (heading an institution with 400 PhD economists) acknowledged this, saying, "I think we now understand better how little we understand about inflation."

4.3 Does higher volatility equal a major paradigm shift in inflation?

In these confusing times, it feels like we are edging closer towards a regime shift, especially when it comes to inflation. The BIS has been firing warning shots in its Annual Report: "We may be reaching a tipping point, beyond which an inflationary psychology

spreads and becomes entrenched. This would mean a major paradigm shift."[2] The BIS report shows that when experienced inflation is low, inflation is not a significant factor in decision making, and inflation volatility remains low as well. However, it observes that once the inflation rate settles above 5% (the BIS demarcates an eight-quarter stretch of inflation above 5% as a high-inflation regime), the inflation level becomes a focal point of attention in decision making, and price increases across sectors of the economy become more similar; the breadth of inflation increases. Persistence also increases as transitions from low- to high-inflation regimes become self-reinforcing; workers not only want to be compensated for past erosion in their purchasing power but also to shield themselves from future erosion of real income growth. Once inflation has become persistent the output costs of bringing inflation back to target are very high. This is also called 'the sacrifice ratio', and was particularly high in the early 1980s.

2. BIS, Annual Economic Report, June 2022, https://www.bis.org/publ/arpdf/ar2022e.pdf

The bar for inflation becoming entrenched is high

The standard way to measure persistence in economic time series (and thus inflation) is through the autoregressive/unit root model. If the null hypothesis or stationarity can't be rejected in favor of the alternative hypothesis of non-stationarity, shocks will eventually dissipate and the series will revert to its steady state. Conversely, if the null hypothesis can be rejected, shocks are permanent and the series do not return to a steady state. An analysis of persistence of inflation finds that even in inflationary episodes like the 1940s or 1970s the evidence to reject the null hypothesis is scant. For instance, Robalo Marques (2004) finds that inflation persistence in the 1970s could be an artefact as it crucially hinges on the assumed long-run level of inflation when computing persistence. He finds that once a linear time trend to measure the mean of inflation in the period 1960-1980 is used instead of a constant mean, it is no longer obvious that persistence of inflation has been higher than in the following decades.[3] In addition, Benati (2008) finds that after the introduction of inflation targeting, inflation persistence significantly declined in the UK, the eurozone and Canada.[4] These econometric studies are *ex post* analyses to assess whether and to what extent inflation had become entrenched and are less helpful to gauge whether inflation will become entrenched in the medium term.

3. Robalo Marques (2004).

The likelihood of inflation persistence varies depending on inertia in the underlying 'driving process such as marginal costs or overheating', meaning actual output stretched above potential output for a considerable period of time, the central bank reaction function, and wage-price setting behavior such as labor bargaining power and indexation. While the US is clearly in overheating territory, the existing slack in the eurozone economy is reassuring with respect to the driving process of inflation. The current state of play with its high independence of central banks with well-established inflation targeting mandates also lowers the likelihood of entrenched inflation. Considering the wage-price setting process, a lower degree of unionization and increased flexibility in labor markets also have pushed the tipping point further out. Of course, there are countervailing powers here: very tight labor markets raise the potential of a wage-price spiral. Also, deglobalization, the disappearance of the peace dividend, energy embargoes, and resumption of the trade war between US and China could leave inflation more sticky.

In addition to these variables and taking the long view, it is also relevant to consider whether the current inflation level has become a focal point of attention for consumers and is feeding into their medium-term inflation expectations. A NY Fed report (2022) shows that while there is a very high responsiveness of consumers to actual inflation surprises, translated into higher short-term (one-year) inflation expectations, the pass-through from short- to longer-term inflation expectations has actually more than halved in the post-pandemic recovery (see Table 4.1)[4]. It seems that consumers recognize the uniqueness of the current macroeconomic environment and are looking through the current inflation volatility in the expectation that the current inflationary impulse will fade.

4. What Are Consumers' Inflation Expectations Telling Us Today? - Liberty Street Economics (newyorkfed.org)

This observation echoes another observation; consumer confidence did not drop proportionately to the huge jump in unemployment during the Covid recession. With hindsight, consumers were proven right to stay relatively sanguine as employment recovered in an unprecedented fashion and consumption rebounded. The wisdom-of-the-crowd effect might manifest again with regard to inflation.

Table 4.1: Sensitivity of revisions in inflation expectations to inflation surprises

	2014-2019	2020-2021
1-year ahead	0.69	0.75
	(0.01)	(0.02)
Observations	4,099	846
3-year ahead	0.45	0.19
	(0.01)	(0.02)
Observations	4,068	842

Sources: Federal Reserve Bank of New York Survey of Consumer Expectations (2014-21); U.S. Bureau of Labor Statistics.

Notes: A respondent's revision in inflation expectation (dependent variable) is defined as the respondent's inflation expectation in month 12 minus the respondent's inflation expectation in month 2. A respondent's inflation surprise is defined as realized CPI inflation in month 12 minus the respondent's expected inflation in month 2. Year is defined as the year of the respondent's second month in the Survey of Consumer Expectations (SCE) panel. Inflation expectations are defined as the respondent's density forecast mean from the SCE core survey. All slope coefficient estimates are statistically significant at the 0.1 percent level. Standard errors are in parentheses.

Thus, reassuringly, the bar to seeing inflation becoming unanchored in the next five years is pretty high. As a result, so far we have insufficient evidence to expect the major paradigm shift towards entrenched inflation and have not penciled it into any of the three scenarios we discuss below and see as the most plausible states of the world. At the same time, we have to be very cognizant that in a high macroeconomic volatility regime, the impact of tail risks such as inflation becoming unanchored increases as well.

Recessions are highly disinflationary

There is another reason to be more sanguine on second-round effects of the current high inflation episode. Paradoxically, this is because recession risk is looming large and is even being deemed as unavoidable on a five-year horizon. In one of the most influential macro papers of 2022, Alex Domash and Lawrence Summers (2022) showed that whenever inflation is above 4% and unemployment is below 5%, the risk of a US recession is 73% in the next year and 100% in the next two years. This view corroborates with the 2s10s inversion of the Treasury yield curve in April 2022. An inversion of this segment of the yield curve typically leads a US recession by 16 months.

In each of our scenarios, therefore, we do anticipate a recession in developed economies, though the severity varies. For the eurozone, even barring the possibility of a complete cut-off from Russian gas and a harsh 2022-2023 winter, which would usher in a more immediate and deeper recession, a recession in itself seems difficult to escape if we look solely at the deceleration in money growth in the Euro area, which is a leading indicator for real activity in 12 months' time.

The key point of a recession appearing on the horizon with regard to the inflation outlook is that it typically harbors significant disinflation. In the case of the 19th century and the first half of the 20th century, it often even harbored deflation, a process that tends to be set in motion well before a recession actually starts.

Table 4.2: The evolution of CPI during NBER recessions

	US NBER recessions and CPI			
	Peak CPI # months into recession	Peak CPI	Trough CPI recession	# months into recession
Average full sample	4	8.27%	-1.43%	10
Average 1872-1900	4	8.66%	-6.67%	11
Average 1901-1923	3	12.94%	-3.81%	11
Average 1924-1964	2	3.05%	-1.73%	12
Average 1965-1982 (Great Inflation)	6	11.08%	9.05%	8
Average 1983-2020 (Great Moderation)	4	4.45%	1.90%	5

Source: Shiller database, calculations Robeco

Possible disinflationary pathways

With the odds of engineering a soft landing dwindling, one of the dilemmas central bankers face is how to cushion the hard landing so as to kickstart growth and avert deflation while at the same time not overdoing monetary stimulus which could fuel another bout of inflation.

In each of the scenarios we only see disinflation, not outright deflation. Regardless of whether we encounter similarities with the late 1940s, the 1970s or more recent recessions, these have typically not led to outright deflation, with the exception of the global financial crisis.[5] Like 1929, the 2007 crisis morphed into a balance sheet recession triggered by a financial sector meltdown. While we do expect some deleveraging in the aftermath of the next recession, we do not expect structural behavioral changes leading to firms switching from a profit maximization objective to a debt minimization objective, for instance.[6] This is because on a scenario-weighted basis, the expected interest rate in developed economies remains just below the real GDP growth rate in the next five years and thereby avoids a vicious debt trap.

One exception could be China, where strong disinflationary pressures might morph into outright deflation as the current mortgage crisis ushers in a prolonged deleveraging cycle, spurred on by the drying up of an 800 million rural-urban migration flow that pushed up real estate prices over the last decades. The ongoing demographic changes in China are key factors to consider in scenario thinking. Its working age population is expected to decelerate more notably after 2025 while its current 16-24 youth unemployment rate has risen to 19.9%, close to Italy's 20.5%.

Lastly, judging by history, significant US deflation (< -1% year on year) necessitates a doubling of the actual US unemployment rate. The Fed will likely make a dovish pivot well before US unemployment hits high single-digit numbers, even if inflation is still above its target. It has done so in 87% of the cases in which US leading indicators signaled contraction despite the fact that inflation, as measured by core PCE, was running well above target (see Table 4.3).

5. The 1949 recession did see deflation, though this amounted only to deflation in the technical sense as it had no impact on medium-term inflation expectations while the breadth of deflation was narrow. See ECB Monthly Bulletin, June 2014.

6. One of the phenomena playing out in a genuine balance sheet recession as described by Richard Koo (2003).

Table 4.3: How likely is the Fed to pivot? (1971-2022)

ISM < 50	Fed policy action in subsequent three months		
Median inflation = 2.8%	Hike	Neutral	Cut
Inflation < median	2%	49%	48%
Inflation 0-2% > median	17%	22%	61%
Inflation 2-4% > median	13%	7%	80%
Inflation 4-6% > median	10%	40%	50%
Inflation +6% > median	50%	0%	50%

Source: Refinitiv Datastream, calculations Robeco

The only exceptions (13% of cases) in which the Fed did not pivot in an inflation environment similar to today's were during the Volcker disinflation episode in 1981 and 1982. Here Volcker needed a second recession to beat inflation after the 1980 recession only saw modest disinflation. While Powell recently expressed admiration for Volcker and stressed that entrenched inflation is a greater worry for the Fed than a recession, it's worth noting that the Fed's reaction function over time seems to be erratic and dynamically inconsistent; meaning that the odds of cutting do not proportionally decrease with higher inflation episodes, exhibiting an inflation bias.

So, the risk is that central banks' sensitivity to growth will still leave inflation elevated throughout the coming slowdown; this right-hand skew to the expected inflation distribution is a key thread throughout our scenario thinking. In addition, a vibrant labor market may keep inflation elevated for longer despite the Fed's efforts. In the last 25 years, US headline inflation has never dropped below 4% as long as the number of job openings per unemployed stayed above 1.3. It is 1.8 at the time of writing. This also raises the odds of a second recession being necessary to finally bring inflation back to target, as we saw in the 1980s. Our bear case anticipates such a state of the world.

4.4 Future is less predictable

Is the Great Moderation ending? Though the recent evidence at hand points in this direction, we should be careful not to fall prey to base rate neglect. If the ongoing demographic reversal in China, the largest contributor to global growth, ultimately proves to be disinflationary as it triggers prolonged deleveraging in its vast real estate sector resulting in subdued consumption growth, the Great Moderation will continue. If, on the other hand, overly growth-sensitive central banks pivot prematurely and abort the tightening cycle without taking the sting out of inflation, we will inch closer to saying farewell to the era of Great Moderation. A third option would be a timely pivot, instigated because inflation has been brought under control, and would be totally different from a central bank that had pivoted only to cushion a hard landing.

So, given these widely divergent potential outcomes, where is the global economy heading in the next five years? The medium-term outcome of the multiplicity of macro shocks we have experienced in recent years is likely to be itself a complex amalgamate. Recent unprecedented macroeconomic volatility suggests the future has become less predictable. Thus, we are entering an age of confusion as we undergo a transition to a world of elevated macro volatility.

4.5 Base case: The hard landing that unstings inflation

It is tempting to take the IMF July 2022 global economic outlook titled "Gloomy and more uncertain" as a contrarian indicator. After all, we know the IMF forecasts are tilted towards underestimating future growth[7] and isn't the darkest hour always just before dawn? Yet, looking ahead, we think the IMF is hitting the nail on the head this time. Moreover, in our base case we even foresee an age of confusion in which, contrary to the IMF, we do pencil in a 2023 US recession. We envisage a global economy that undergoes a wobbly, drawn-out recovery after a recession in 2023 cools demand enough to ease the worst inflationary pressures.

7. An analysis by Bloomberg (2019) shows that the IMF underestimated future growth in 56% of the cases, see https://www.bloomberg.com/graphics/2019-imf-forecasts/.

Background

In our base case 2022-2026 last year, we predicted that "inflation may prove to be less transitory than assumed". Central banks have by now realized they were behind the curve, as standard Taylor rules convincingly show, and have no other option than to tighten financial conditions to slow their economies and restore the supply-demand balance, as well as their credibility as inflation fighters. What we didn't predict was the strongest increase in nominal yields in the past 40 years on the back of a surge in inflation and steep erosion of household purchasing power. This has changed the outlook for the US economy. We therefore downgrade the US growth trajectory from 2.3% to only 1.75% annualized real GDP growth in the next five years as both the propensity and ability to spend for the US consumer (which accounts for almost 70% of total output in the US) has weakened, and offsets seem largely absent, either in the form of a capex boom or an export boom, with the major exception of LNG and defense exports.

Four sputtering consumption growth engines

The three engines we envisaged last year that were necessary to sustain above-trend consumption growth in the next five years for developed market economies have already started sputtering. First, real interest rates are not historically low anymore and are now only to a lesser extent incentivizing consumers to frontload consumption while at the same time depressing housing affordability, which is the percentage of median household income that goes to mortgage payments for a median-priced house. Housing affordability levels have plunged since last September with mortgage rates since doubling, and are already close to cyclical peaks. However, we observe that in the early 1980s housing affordability worsened considerably from levels similar to today's and also featured a central bank in inflation fighting mode.

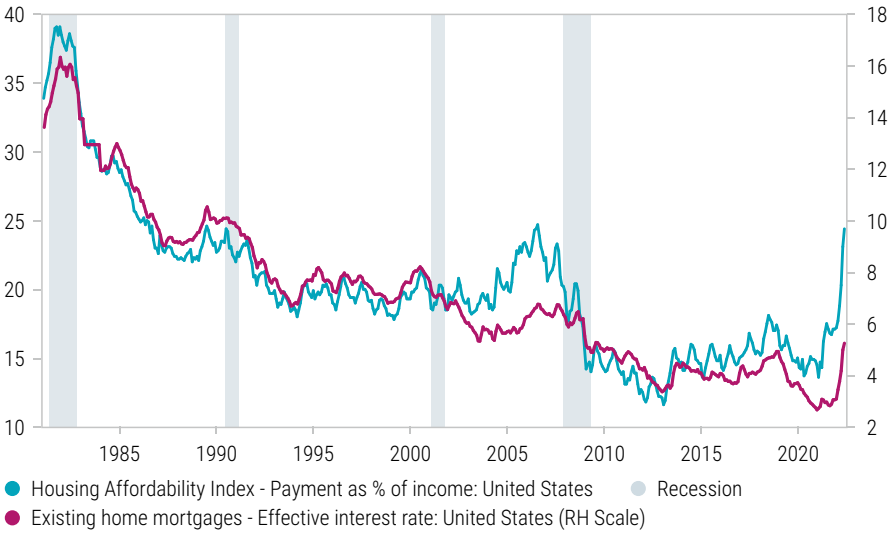
Secondly, cyclical peaks in housing affordability levels often herald the onset of a housing market slump which we did not pencil in last year. A bear market in residential real estate depletes the wealth effect and thereby inhibits consumer willingness to spend because they feel less wealthy. A 2019 empirical study by Cacares on the marginal propensity to consume out of US housing wealth concludes that the wealth effect is sizeable with a 10% drop in US house prices leading to a drop of 1%-1.4% in consumption (the Shiller US house price index has increased 124% since its February 2012 trough). Cacares concludes that "a large correction in housing prices could still pose significant risks to consumption".[8] Though this effect varies widely across regions, it is also important to flag that the correlation between Chinese house prices and consumption growth is also substantial (72%).

8. Cacares (2019).

Thirdly, our upbeat view on supply side repairs leading to productivity growth and subsequent accelerating real wage growth has not materialized so far. Although this view could still prove valid given the typically long leads of 2020/2021 capex spending to transpire into productivity growth, both productivity growth as well as US real wage growth have instead slumped into negative territory since last year.

Lastly, we observe that excess savings stemming from various post-pandemic government support programs have been largely depleted. US household savings are still sizeable at USD 1 trillion, but have now converged from a peak total of USD 4.7 trillion back to the long-run trend. As savings ratios declined, outstanding revolving consumer credit debt has surged with a 15% increase year on year. This extension of consumer debt to uphold consumption cannot be maintained in the face of a recession and its aftermath.

Figure 4.2: Housing affordability close to cyclical peak as mortgage rates jump

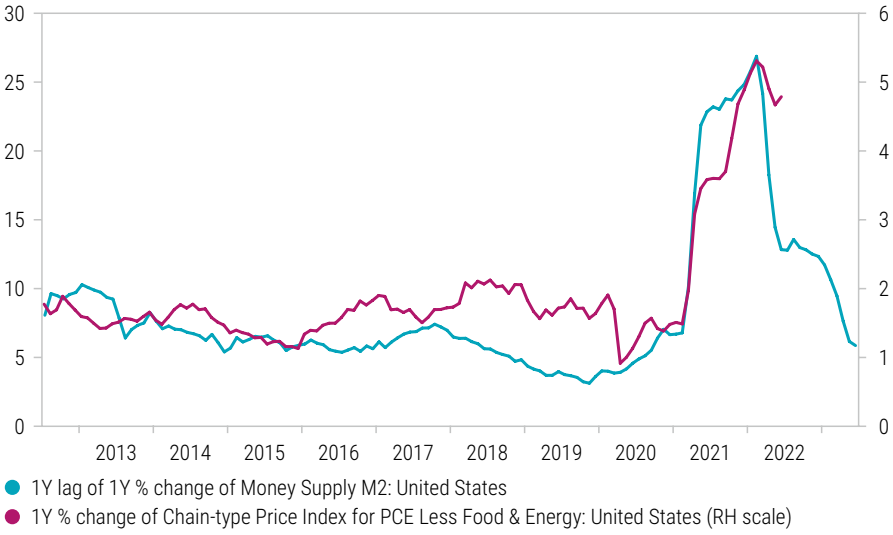


Source: Refinitiv Datastream

Diverging tightening paths

The US economy has overheated with actual output exceeding potential output, pushing up nominal wage growth with the labor market being excessively tight, as portrayed by an almost 2:1 ratio of job vacancies per unemployed person. While Powell said in early 2021 that we should perhaps "unlearn" the economic textbook relation between monetary aggregates and output and inflation, we should not dismiss too easily Friedman's famous quote: "Inflation is always and everywhere a monetary phenomenon". Looking at the relationship between M2 growth and core PCE, M2 growth clearly leads core PCE by one year.

Figure 4.3: Should central banks relearn Friedman?



Source: Refinitiv Datastream, Robeco

In order to tame inflation, real policy rates in the US need to become positive the way they historically have been at the end of every post-WWII tightening cycle. The Fed will likely do this in early 2023 as it frontloads rate hikes to prevent inflation from becoming entrenched and avoid more hardship further down the road.

Europe faces a different dynamic because, in contrast to the US, eurozone actual output remains below potential with inflation pressures not emerging primarily from domestic sources but via imported inflation (as a net energy importer) and a cheapening currency. The existing slack in the eurozone therefore provides a rather short runway for the ECB to tighten monetary policy. We think the ECB, unlike the Fed, won't be able to hike towards the neutral rate of interest and we therefore continue to expect negative short-term real policy rates in the next five years for the eurozone. As the year 2023 progresses, there is no reason to cheer for developed market central banks. Not only because they failed to engineer a soft landing, as Summers and Domash (2022) predicted. Despite sizeable disinflation from high single digits during the 2023 recession, core inflation will remain stubbornly elevated by 50 to 60 bps above their 2% inflation targets in the aftermath, only to gradually decelerate towards their targets by 2026. Persistent core inflation here will force the Fed to carry out only a few 'hawkish' rate cuts during the 2023 recession, but overall easing will remain modest to signal their bias towards fighting inflation so as to maintain credibility as inflation fighter. Instead, the Fed will mainly try to counteract the cyclical downturn by using its balance sheet.

The reason for persisting core inflation pressures stems from the fact that large existing imbalances in supply and demand align only very gradually, given three sources of inelasticity slowing progress.

Three sources of inelasticity

Worsening demographics

The most prominent source of inelasticity emerges from wages chasing prices against a backdrop of weak productivity and therefore elevated unit labor costs. Labor markets will remain relatively tight, even in the aftermath of a 2023 recession. First, labor force participation rates do not revert back to their pre-Covid levels even though more early pensioners decide to return to the labor force due to the unexpected decline in their wealth levels in 2022. Covid-related anxiety and long Covid initially inhibit a return to the workforce for older age cohorts but this effect fades towards 2027, as treatments, boosters, herd immunity and mutations render the virus as harmless as other common respiratory viruses.

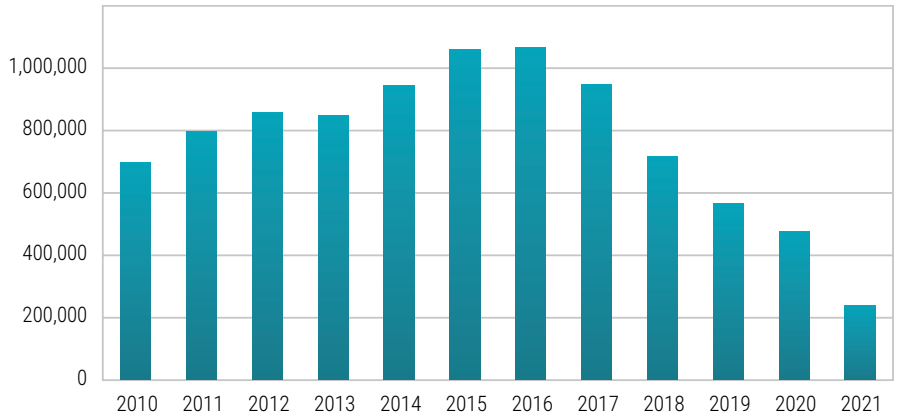
Secondly, the current geopolitical upheaval introduces a multipolar world with lower migration rates as countries grow more inward-looking and more restrictive in this regard. The steady fall in US net migration since the 2016 Trump presidency has already contributed to the overheating of the US labor market (Figure 4.4) and will only continue to restrict US labor supply. In 2022, only 33% of US citizens want an increase in immigration from current levels.[9]

Thirdly, in China the working age population peaked in 2015 and will start to shrink more noticeably around 2025, gradually limiting the supply of cheap labor that the country has exploited over the last two decades with its 812 million-strong labor force.[10] While other countries like India will take the baton in the next decade, swift substitution in the medium term for the contraction of around 0.2% on an annual basis in China's labor force (Figure 4.5) will prove difficult because of the time it takes to re-design supply chains.

9. https://news.gallup.com/poll/1660/immigration.aspx

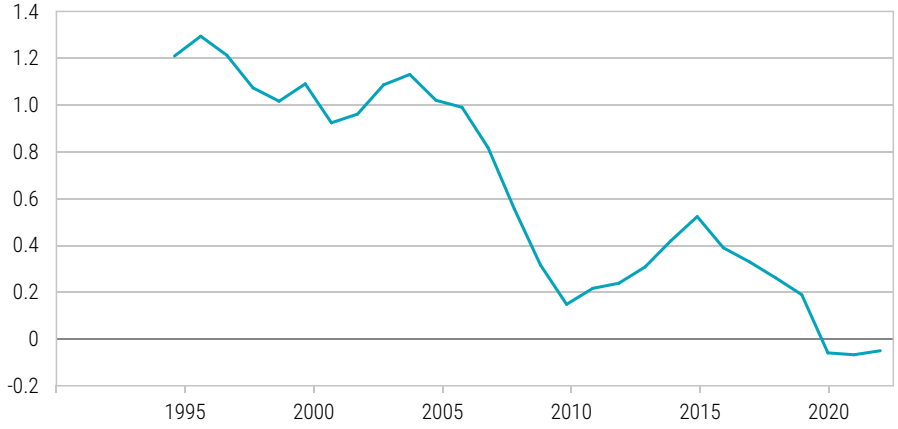
10. See the latest UN 20-64 year population projections for China, https://population.un.org/wpp/Graphs/Probabilistic/POP/20-64/156

Figure 4.4: Slowing net migration into US source of overheated labor market



Source: U.S. Census Bureau, vintage 2021 population estimates

Figure 4.5: A major demographic reversal in China



Source: Refinitiv Datastream, Robeco

Underinvestment among commodity producers

Another factor where supply has proven to be relatively inelastic and will remain so in our base case is the energy and metals and mining sector. Although there is a surge in commodity prices as seen in the GSCI Spot Commodity Index, which is up 178% since April 2020, capital expenditures have remained subdued. The capex level in the global metals and mining sector is almost 20% below its long-run trend. In the oil sector, capital discipline has been even higher with capex at 35% below trend. Not only is a stronger focus on shareholder value inhibiting a supply response from commodity producers, but also rising cost of capital, both from the perspective of an ongoing monetary tightening cycle and sustainability considerations. The cost of capital for miners with the lowest ESG score can be 20 to 25% higher than for those with higher ESG scores.[11] While demand for commodities typically drops around recessions, supply-demand imbalances in commodity markets linger in our base case, again spurring headline inflation in 2024 and subsequently spilling over into core inflation, with the global economic recovery gaining a stronger footing by 2025.

11. See https://www.mckinsey.com/industries/metals-and-mining/our-insights/creating-the-zero-carbon-mine

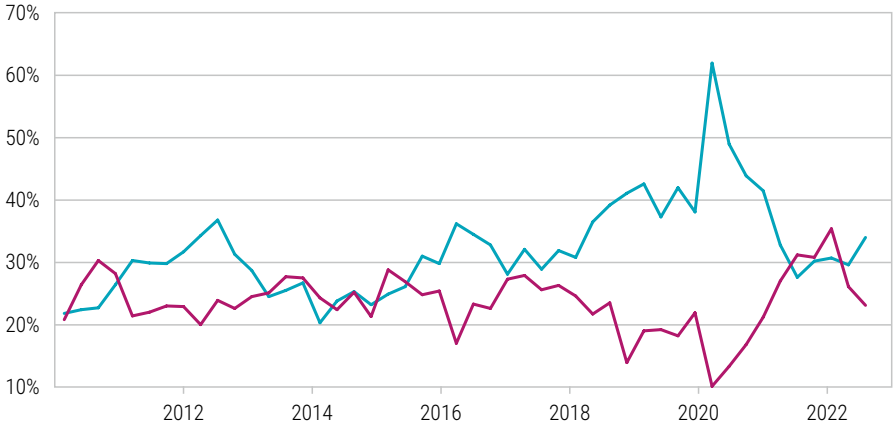
Corporate speed of adjustment stalls

The supply response of goods and services to a recovery in aggregate demand post-2023 proves to be relatively inelastic for a third reason. Higher real rates, a 2023 earnings recession and a highly uncertain investment climate inhibit capital spending. Moreover,

there is a risk that capex spending aimed towards the redesign of global supply chains becomes less efficient (see our special on globalization). Corporates remain preoccupied with defensive strategies rather than expansionary strategies focusing on reducing costs, reducing leverage and increasing cashflow, as seen in Figure 4.6.

Figure 4.6: CFOs rethinking capex

CFO priority: expansionary vs defensive strategies



Arithmetic average of the % of CFOs who rated expansionary (magenta) and defensive (blue) strategies as a strong priority for their business over the next 12 months. Expansionary strategies are introducing new products/services or expanding into new markets, expanding by acquisition and increasing capital expenditure. Defensive strategies are reducing costs, reducing leverage and increasing cash flow.

Source: Refinitiv Datastream

4.5.1 Common Prosperity requires uncommon shift in economic structure

Demographics in the sense of the earlier described declining working age population does not necessarily seal the fate of the future economic growth trajectory, as long as this decline can be compensated by GDP growth per capita. But achieving the goals of its Common Prosperity program proves as challenging for China as every other country that has seen a credit boom into broadly unproductive sectors while trying to escape the middle-income trap (often caused by drying up of cheap labor resources and lower return on capital). "Enlarging the economic pie", as President Xi called it at the last WEF[12] , via boosting high-end manufacturing and domestic supply chains, proves to be a fight against habit formation. The Chinese Communist Party (CCP) recognizes the much-needed shift to upgrade domestic supply chains as the world becomes multipolar, and focuses more on security of supply chains than on efficiency. This shift towards boosting the industrial sector requires a key pivot in China's investment process to look for scarce opportunities after decades of allocating abundant capital to real estate and infrastructure as a default choice. The fact that rental yields in major Chinese cities are at or even below the Chinese policy rate is indicative in this respect. Reorienting capital allocation thus requires an uncommon shift in habits. We expect Chinese policymakers to only partially succeed in boosting GDP per capita and see Chinese real activity expand at a 4.4% geometrically annualized rate over the next five years.

12. https://www.weforum.org/agenda/2022/01/address-chinese-president-xi-jinping-2022-world-economic-forum-virtual-session/

On the nature of the global recession

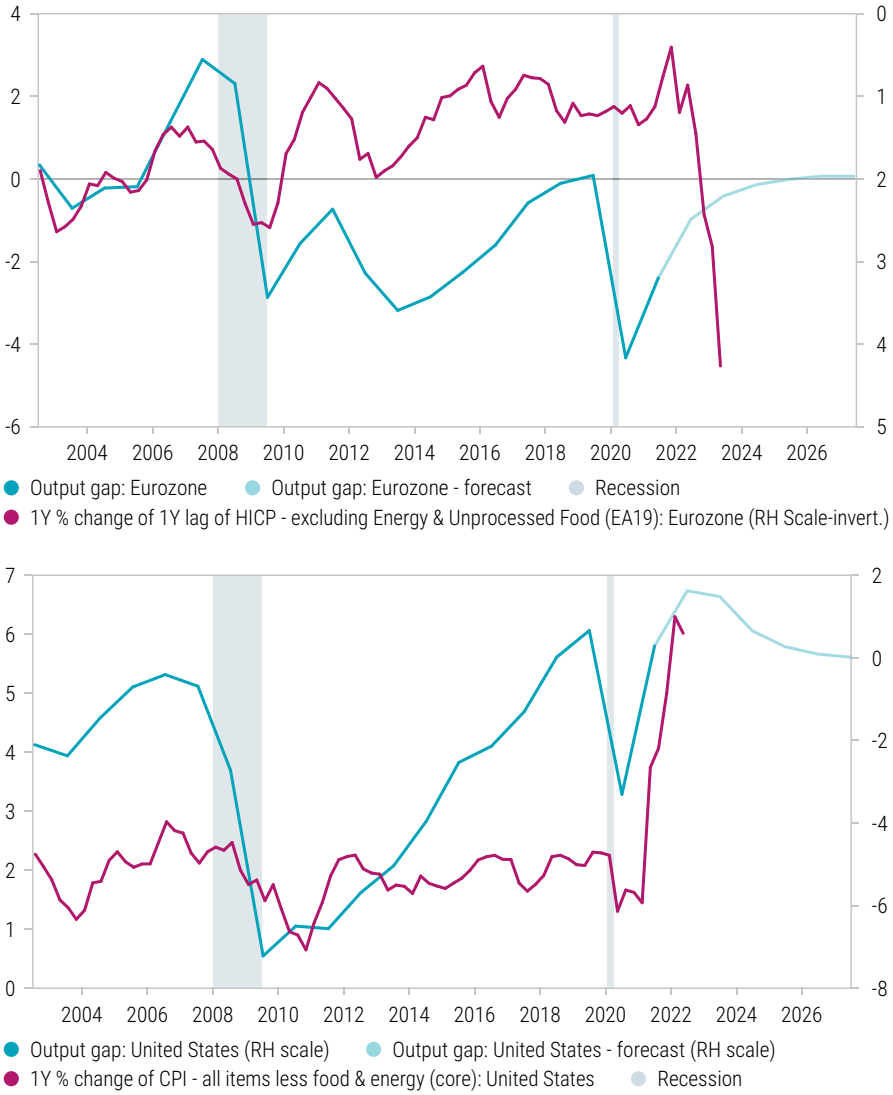
The 2020 recession was deep but short. The NBER only dated two months of contraction for the US economy. In our base case, we don't see inflation spiraling out of control and as a result expect an average depth and duration of the recession as the degree of excess monetary policy tightening needed to contain inflation is limited. In addition, financial soundness indicators suggest the risk of a classic recession morphing into a financial crisis is limited, though decompression of liquidity premia through QT could add stress to

highly leveraged segments in the corporate sector. Household debt levels are generally below pre-global financial crisis levels and banks are better capitalized with a 13,2% CET1 ratio as of June 2021.

All the same, the issues that have been the focus of the Expected Returns publication in recent years will still surface: pockets of excess corporate leverage, high income inequality, and zombification. These excesses that would typically have been cleaned up in a classic recession have only partly been eliminated by the atypical 2020 Covid recession and are still very much with us.

A default cycle develops, with default rates rising to high single digits in the lowest rating segment. Consequently, core inflation drops due to lower consumption growth, forced deleveraging, rising corporate and household defaults, and a depleted wealth effect as financial markets are dealt a severe blow in the initial stagflation episode. In the aftermath of the recession, there is a high degree of Ricardian equivalence inhibiting consumption among higher income classes as there is a significant income redistribution, given bouts of civil unrest during the stagflation phase. As the recession is relatively shallow, the subsequent recovery also proves to be sluggish.

Figure 4.7: Two output gap tales, same ending?



Source: Refinitiv Datastream, Robeco

4.6 Bull case: The Silver Twenties

What if the multiplicity of today's shocks ultimately has a silver lining for the global economy? In our bull case scenario, a modest slowdown alone manages to contain inflation, echoing the inflationary episode of 1946-1948 which was caused by the elimination of price controls, supply shortages and pent-up demand. Back then inflation ultimately proved to be of a transitory nature and had already started to decelerate prior to the mild recession in the first half of 1949. A vigorous economic recovery followed.

In our bull case, therefore, we expect US real GDP to rebound to 3.75% in 2024 and see its 5-year geometric annualized GDP grow at a healthy above-trend growth rate of 275% in the 2023-2027 period. This is predicated on our view that innovations stemming from green capex and the post-Covid capex boom will finally start to appear in productivity data. The recently enacted Inflation Reduction Act, earmarking USD 369 billion (of a total of 790 USD billion) for spending on the US clean energy economy, starts to create a big cyclical upswing after 2026 in green capex. In addition, the increase in the 35-44 age cohort in the US labor force, the most productive labor force cohort according to Arnott and Chaves (2012), bodes well for US productivity growth.

With regard to China, the country manages to establish Covid herd immunity in 2023 as well as a controlled deleveraging of its real estate sector, enabling it to achieve the CCP's 5.5% annual growth target. The 'three red lines' policy for the property sector bears fruit.[13] A modest recovery in the real estate sector from 2024 onwards reboots Chinese consumption growth, thanks to the critical importance of its real estate sector for consumption via the wealth effect. For example, around 70% of Chinese household wealth consists of housing-related wealth.

The Euro area, too, benefits from China's recovery via export growth, further boosted by an undervalued euro. However, the real game changer comes in the form of a ceasefire in Russia's war in Ukraine. This not only brings down energy-related inflation, boosting consumer confidence, but also creates leeway for the ECB to lower policy rates again.

The icing on the cake is that Europe accelerates its move away from Russia as a major energy supplier via LNG import terminals and accompanying long-term LNG contracts and becomes strategically independent from Russia. At the same time, the energy transition contributes to Europe's Fit for 55 goal.[14] Under its REPowerEU initiative, it successfully taps into alternative sources of energy, lowers the energy intensity of production and diversifies energy supplies. It agrees to a transatlantic energy and climate pact with the US.[15] Thanks not only to the effective combating of Covid by institutions and policy makers but also their warding off of a major energy crisis, citizen trust levels are restored.[16] This boosts consumption growth.

In this way, the global economy is able to generate above-trend productivity growth for longer as dislocations in goods and labor markets that have pressured companies to adapt are resolved more quickly compared to our base case, given ongoing investment activity towards restoring supply chain resilience without compromising efficiency. The improved trade-off between Ricardian efficiency and resilience and sustainability compared to our base case leaves a more favorable outcome for corporate profitability. These supply-side improvements lower the non-cyclical inflation pressures in the first half of our projection period, while cyclical inflation trends lower due to more oil supply from the US and China lowering the energy intensity of production. Further, on a macro scale the productivity gains of firms that are able to catch up with the existing technological frontier outpace the losses from the laggards. The demise of unproductive companies during the 2023 slowdown allows for an inflection point towards a higher trend in GDP per capita growth in developed economies in the ensuing expansion phase.

13. The People's Bank of China and the Ministry introduced the Three Red Lines Policy in August 2020, with the aim to improve the financial health of the real estate sector by reducing developers' leverage, improving debt coverage, and increasing liquidity. Three Red Lines Criteria: (1) Liability to asset ratio of less than 70% (excl. advanced receipts); (2) Net gearing ratio of less than 100%; (3) Cash to short-term debt ratio of at least 1.

14. Fit for 55 refers to the EU's target of reducing net greenhouse gas emissions by at least 55% by 2030. See https://www.consilium.europa.eu/en/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/

15. https://www.intereconomics.eu/contents/year/2022/number/4/article/a-transatlantic-energy-and-climate-pact-is-now-more-necessary-than-ever.html

16. The Edelman Trust monitor 2022 shows a further decline of public trust in governments (52% of the public trusts governments to do what is right) and the lowest reported levels of economic optimism at the family level about the five year outlook since 2001 in G7 countries.

A more constructive dialogue between the US and China on a broader range of topics sees lower tariffs on Chinese goods imported into the US, and vice versa, while the US convinces Chinese diplomats that it will stick to its long-held One China policy, maintaining the status quo regarding Taiwan. Given a more outspoken corporate shift towards disinflationary labor-saving technology compared to the base case (also as wage growth remains elevated), central banks observe that the NAIRU or non-accelerating inflation rate of unemployment has dropped and modestly lower policy rates after 2025. Given a higher natural real rate of interest and lower inflation pressures, central banks are more accommodative compared to the base case at the end of the projection period.

Yet, it is not the 'Golden Twenties'. The significant recovery in global aggregate demand, also from an accelerated green economy transition, causes swings in commodity prices and strong cyclicality in headline inflation even as overall inflation trends downward during the projection period. This squeezes real purchasing power, especially for the lower-income cohorts. Higher real rates cause the global housing market to cool as well.

4.7 Bear case: The Stag Twenties

What if the current global tightening cycle and the ensuing recession in 2023 are not enough to knock stubborn inflation off its pedestal? In this bear case scenario, the 1970s echo loud and clear as far as the reaction function of the Fed is concerned. In the 1970s central bankers gave in too easily to the pressure from President Johnson to support the Vietnam War and his Great Society spending program and pursued a lower degree of tightening than underlying inflation pressures warranted in order to accommodate large and rising fiscal imbalances.

Despite declaring inflation "public enemy number one" in 1974, President Nixon failed to curb inflation through the non-monetary measures he introduced like wage and price controls. With high inflation persisting, consumers factored in an inflationary bias in Fed policy. In other words, inflation expectations became unanchored and inflation became entrenched via second-round effects, such as workers demanding higher wages to compensate for the steady erosion of their purchasing power, which fed back into inflation. It took Fed hawk Paul Volcker two recessions in the early 1980s to end the era of Great Inflation and ultimately usher in the era of Great Moderation.

Our bear case posits that we are indeed inching closer to the tipping point that the BIS recently warned against as the Fed shifts priorities, seeing more evidence of immediate recession risk by the end of 2022 and making a dovish pivot while inflation is still uncomfortably above the 2% inflation target. Our analysis of the reaction function of the Fed, which is summarized in Table 4.3 in the introduction of this chapter, shows that historically the Fed has changed course and cut policy rates in 80% of the cases observed since 1900 where inflation was still running 2 to 4% above the median 2.8% US inflation, and the leading ISM indicator was flashing recession risk as it dropped below 50. Though the pivot comes too late to avert a NBER recession in 2023, it hinders adequate cooling of aggregate demand necessary to stabilize medium-term consumer inflation expectations. As in the 1970s, the public takes note of the inflationary bias of the Fed exhibited by its premature pivot.

Thus, the threat of a paradigm shift where a public inflationary psychology settles in to extrapolate higher prices into the distant future still looms. In the subsequent recovery phase in 2024 wages rise again and the expansion phase in 2025 even sees core inflation once again at 4.75%. This now clearly starts to worry the Fed and it embarks on an aggressive tightening cycle in 2026. By the end of 2027 yield curves have inverted again and another, potentially deeper, recession appears on the horizon.

While policy rates for the US are lower in the 2023-2024 episode compared to our base case, the recession is nonetheless longer as consumer confidence does not recover as quickly as in the other scenarios because of high experienced inflation. The 1970s reverberate here as well with high inflation eventually leading to higher unemployment towards 2027.[18] With inflation in developed economies remaining in the 3–4% bracket during our projection period and central banks not prioritizing elimination of the post-pandemic inflation overshoot, bond vigilantes start to push back and again demand higher inflation compensation in the sovereign bond markets. In turn, higher yields limit the available fiscal space and as a result the fiscal thrust to safeguard the global economy subsides.

18. In early 1980, Volcker said, "[M]y basic philosophy is over time we have no choice but to deal with the inflationary situation because over time inflation and the unemployment rate go together… Isn't that the lesson of the 1970s?" (Meltzer 2009, 1034).

In this bear case scenario, myriad actual risks materialize as reflexivity abounds, both in financial markets as well as the real economy. The weak footing of the US consumer in 2023 sends ripple effects to the rest of world. China, already struggling with a deepening real estate crisis at home, is unable to compensate domestic demand shortfall with export revenues. In the meantime, the country continues to battle Covid through strict lockdowns. Though the virus become endemic in large parts of the world, this does not hold for China. The development of a homegrown and effective mRNA vaccine proves cumbersome and prolongs lockdown intensity. Not only does this inhibit progress towards natural immunity, it also prolongs a public and mental health crisis.

Growing unease with the harsh measures, devalued household real estate portfolios and rising unemployment due to sluggish exports leaves the CCP more likely to deflect attention away from domestic malaise by stirring up tensions around Taiwan. These approach boiling point and the threat of the diplomatic relationship between the US and China breaking down looms.

Other tensions between the superpowers also rise because of persisting differences of opinion about Russia's war in Ukraine that evolves into a war of attrition. In this bear case, Europe still struggles to wean itself off Russian gas, remaining vulnerable to Putin's energy blackmail while allowing the Russian war chest to grow over time. Failed strategic energy dependence also leaves headline inflation higher for Europe compared to the base case. The continuing threat of a broader war along Europe's borders sees defensive spending well above NATO's investment guideline of 2% of GDP across Europe. Russia's war in Ukraine will, in words likely uttered by Winston Churchill, be ended "by the exhaustion of nations rather than the victories of armies". ●

EXPECTED RETURNS 2023-2027

5. Expected returns

We calculate expected returns for the main asset classes using our steady-state capital market assumptions, taking into account our assessment of their valuations, the macroeconomic consequences of our three main scenarios, and the effect of climate change on our forecast. Increased economic policy uncertainty makes determining our estimates more challenging and conviction is lower compared to previous years.

Last year, we predicted only a modest increase in inflation. The continued pandemic-related fiscal stimulus, supply chain problems, and Russia's war in Ukraine have contributed to unexpectedly high inflation over the past year. Many countries experienced near double-digit inflation rates last seen in the 1970s and beginning of the 1980s. Only veteran investors have previously experienced the devastating effect that high inflation rates have on purchasing power and investment portfolios.

Table 5.1: Five-year return forecast for the main asset classes

	Long-term	Medium-term influences				Forecast in EUR			USD	JPY	GBP
	Returns	Valuation	Macro	Climate		2023-27	2022-26		2023-27	2023-27	2023-27
Fixed income											
Domestic cash	3.50%		+/+		↑	1.00%	-0.25%		2.50%	0.00%	2.25%
Domestic bonds	4.00%	-/-	=	=	↑	-0.50%	-1.50%		3.25%	-0.50%	2.25%
Developed	4.25%	-/-	=	=	↑	1.00%	-0.50%		2.50%	0.00%	2.25%
Emerging debt	5.75%	+/+	-/-	-/-	=	2.75%	2.75%		5.75%	-0.25%	4.00%
Corporate inv grade	5.00%	=	-/-	=	↑	1.75%	0.25%		3.25%	0.75%	3.00%
Corporate high yield	6.00%	+/+	-/-	-/-	↑	2.75%	1.50%		4.25%	1.75%	4.00%
Equity											
Developed	7.00%	-/-	=	-/-	↓	4.00%	4.25%		7.25%	1.25%	5.25%
Emerging	7.50%	+/+	-/-	-/-	↑	5.25%	4.00%		8.25%	2.00%	6.50%
Real estate	6.00%	=	=	=	=	3.75%	3.75%		6.75%	0.75%	5.00%
Commodities	4.00%	-/-	+/+	+/+	↓	4.00%	5.00%		7.00%	1.00%	5.25%
CPI											
Inflation	3.00%					2.25%	2.00%		2.75%	1.00%	3.00%

Source: Robeco. September 2022. The medium-term influences correspond with our qualitative assessment of the valuation, climate and macro influences described in Chapters 2, 3 and 4. For equity-like classes, our medium-term influences are assessed relative to developed equities. The expected returns are geometric and annualized. Bond returns are euro-hedged except for emerging market debt (local currency). The value of your investments may fluctuate, and estimated performance is no guarantee of future results.

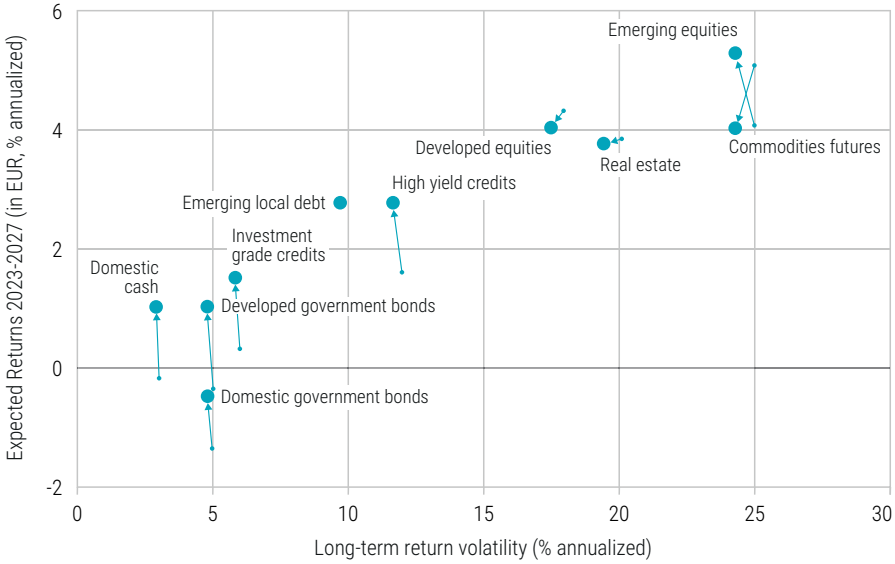
We expect asset returns in euros to remain below their long-term historical averages over the coming five years, mainly due to the low risk-free rate and, in some cases, subdued risk premiums, except for commodities.

However, the increase of nominal risk-free interest rates has resulted in an upgrade of returns for many fixed income asset classes. We have reduced the expected return on equities slightly, leading to a 4% geometric total nominal return on a developed equity market portfolio. Compared to last year, taking equity market risk is somewhat less rewarded compared to fixed income risks. It is the first time that we expect that the equity risk premium will be below its long-term average. Table 5.1 summarizes our expected returns for the major asset classes.

For the first time, we have now also included returns in three major foreign currencies in addition to our home currency, the euro. These reflect our view of the developments of short-term interest rates in these countries for the fixed income asset classes that are currency-hedged, and our view of currency strength or weakness in case of the asset classes that are unhedged.

The returns for a US dollar investor are higher as the risk-free interest rate is substantially higher in the US, while we expect the US dollar to depreciate 3% per year against the euro, and the Japanese yen even 6%. For a US dollar investor, this means that investing in currency-hedged fixed income asset classes is not very rewarding, but open-currency asset classes such as emerging debt and global equities lead to high returns, even higher than our long-term steady-state returns.

Figure 5.1: Five-year return forecast versus long-term volatility



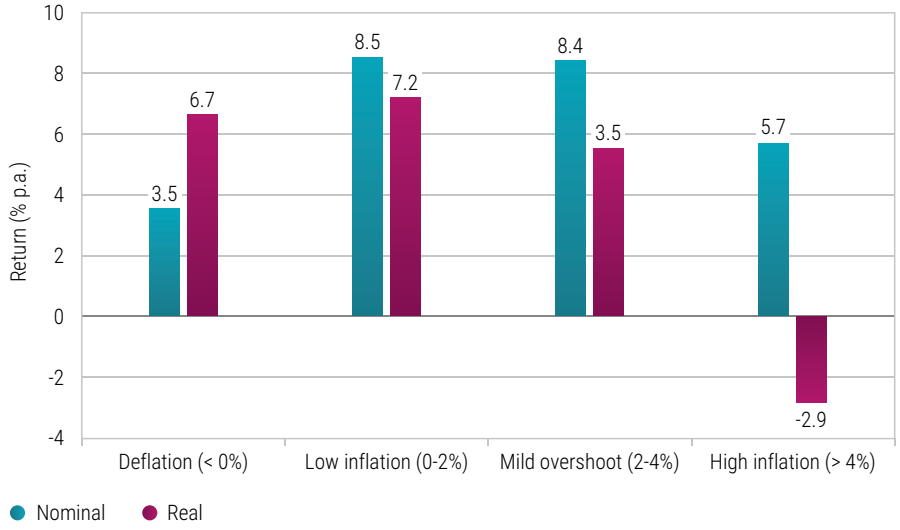
Source: Robeco. September 2022. Vertical axis contains the geometric annualized returns for euro investors over the period 2023-2027. The horizontal axis is a proxy for the long-term return volatility of each asset class.

Figure 5.1 plots these expected returns against long-term volatility estimates for each asset class. Note that whereas these returns are for the next five years, the volatility figures are long-term estimates and are close to what has been observed in practice over the long term. Although it might be tempting to eyeball a mean-variance efficient frontier, it would be unwise because we have not considered correlations in our analysis. Assets with low correlations to other asset classes may still form part of a mean-variance efficient portfolio, even when their expected returns are low. Molenaar and Swinkels (2022) indicate that the correlation between the returns of stocks and bonds tends to be positive in periods in which inflation is higher. This suggests that diversification benefits over the next five years may be lower than we have seen in the past, and investors have to look to other asset classes to reduce overall portfolio risk.

Figure 5.1 shows that government bonds look particularly unattractive from a risk-return perspective. For most risky asset classes, the expected return for the volatility we believe they are likely to involve is substantial, resulting in attractive prospective Sharpe ratios. The biggest mover from last year is emerging markets equities, with a 5.25% return compared to 4% last year.

Baltussen, Swinkels, and Van Vliet (2022) analyzed investment returns in inflationary periods since 1875. Figure 5.2 shows that a globally diversified portfolio of stocks and bonds has a positive nominal return of 5.7% per annum, but this translates into a real, i.e. inflation-adjusted, return of -2.9% per annum when annual inflation is above 4%. In other words, inflationary periods are by far the worst when it comes to investors' purchasing power. Also this time, financial markets have reacted sharply to the inflation shock and both stocks and bonds experienced large negative returns in the first half of 2022. In this chapter, we evaluate whether this repricing now implies that forward-looking five-year returns have substantially increased.

Figure 5.2: Nominal and real portfolio returns across inflation regimes



Source: Baltussen, Swinkels, and Van Vliet (2022), Robeco. Historical average nominal return and real return on a global portfolio consisting of 60% equities and 40% government bonds. The sample period is 1875-2021.

In the remainder of this chapter, we explain how we have calculated these expected returns.

5.1 Cash

Cash has several functions in a multi-asset portfolio. It is safe to say its role as a safe haven has been highlighted so far in 2022, a year when equity-bond correlations moved into positive territory. A euro-based investor would have lost 0.3% by staying in cash whereas the MSCI World lost 13.3% and the global sovereign bond market shed 7.6% (hedged in euro). In the long run, cash has beaten inflation by an average of 0.7% since 1900. Besides this, cash serves as the cost of capital for allocations to other assets and provides liquidity to the portfolio which allows investors to take advantage of opportunities whenever they arise. The opportunity costs of holding cash in a broad-based bear market are low. Year to date, only commodities have outperformed cash within the traditional multi-asset class universe.

Will cash maintain this favorable relative performance profile in the multi-asset space in the next five years? In our base case we project a higher cash return than we have done over the last seven years (2.5% for the US, 1% for the eurozone) but think its relative outperformance will decline once bond-equity correlations roll over and bonds offer diversification again versus equities. Typically this will happen just before we reach the peak in the Fed policy rate as the bond-equity correlation typically leads the Fed policy rate by one quarter.

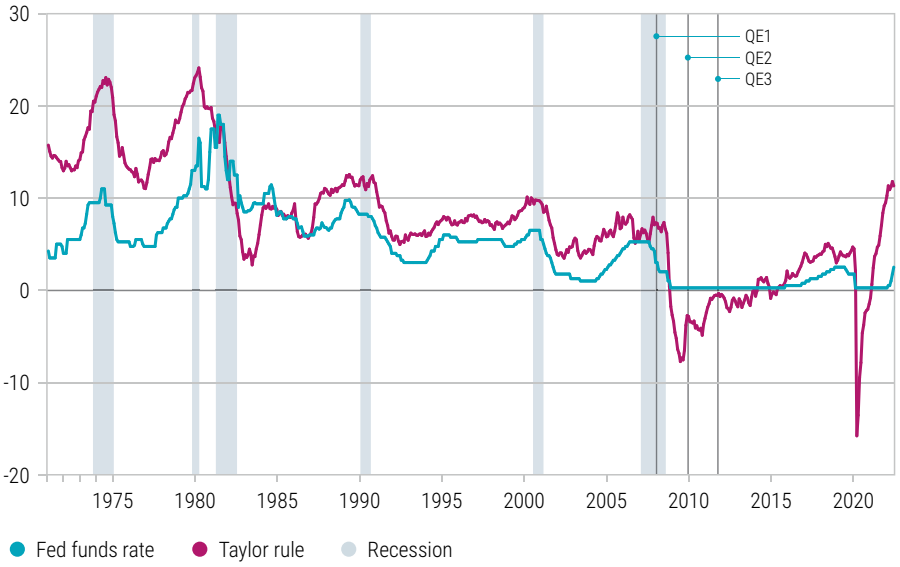
Figure 5.3: Correlation of bond-equity typically peaks just prior to peak of tightening cycle

Source: Refinitiv Datastream, Robeco

The peak Fed policy rate will be reached when the central bank feels inflation has been contained, an NBER recession enters center stage, or a combination of both. Theoretically, today's rules-based central banks should be guided by their estimates of the neutral rate of interest with regard to their rate-setting policy. The difficulty is that the neutral rate is unobservable, or as former FOMC member Kevin Warsh once stated: "r-star is not a beacon in the sky but a chimera in the eye". On top of that, good model estimates are scarce. A leading expert on the neutral rate, John Williams of the NY Fed, has not updated his model for almost two years now, citing "extraordinary volatility in GDP". In today's volatile business cycle, central banks are even less reliant on the neutral rate estimates of their staff for rate setting, especially after the huge miss in staff predictions on the easier target, inflation, last year. Judging from a standard Taylor rule, the failure to accurately gauge the inflation path in 2021 has left central banks massively behind the curve in 2022.[1]

1. Our version of the Taylor rule assumes that central banks should change monetary policy in response to two deviations: (i) deviations between actual inflation and the central bank inflation target, and (ii) deviations between actual unemployment and the estimated non-accelerating inflation rate of unemployment (NAIRU).

Figure 5.4: Taylor model hinted Fed was ending up behind the curve already in spring 2021



Source: Refinitiv Datastream, Robeco

A four-stage tightening cycle

Instead, central banks will likely follow a four-stage process. In the first stage, which we are currently experiencing, there is a laser-like focus on combating inflation and preventing second-round effects from taking hold in wage-setting behavior. Ultimately, credibility is at stake here: in the central bank utility function, losing price stability is more costly than inadvertently triggering a recession. Also from a career-risk perspective there appears to be an asymmetric pay-off for central bankers at this juncture by prioritizing fighting inflation over preventing a slowdown in the cycle; Volcker has been lauded for controlling the rampant 1970s inflation with his 'cold turkey' approach that saw two recessions in the early 1980s before inflationary dynamics became well behaved.

In the second stage, inflation has peaked and steady disinflation from very elevated inflation levels emerges. Relieved to see the path of inflation normalizing, central bankers start paying more attention to the business cycle. Smaller rate hikes are initiated as the prioritizing of inflation fighting over averting a hard landing becomes less pronounced. Meanwhile, discussions within the central banking community about the neutral rate grow more intense in order to gauge the terminal policy rate for the cycle as the actual inflation overshoot shrinks while medium-term inflation expectations stabilize. In the eurozone in particular, which entered the tightening cycle with considerable economic slack, fear of excess tightening, namely actual policy rates overshooting the neutral rate, takes hold sooner.

In the third stage, the pay-off function for central banks becomes more symmetrical. Core inflation is still running considerably above target, but the growth slowdown is becoming more pronounced as well, and the employment situation less favorable. In the US, the number of job openings per unemployed dives below a 1:1 ratio, back from a 2:1 ratio at the onset of the tightening cycle. The pace of rate hikes slows as rate hikes are decided on a meeting-by-meeting basis.

In the fourth stage, consistent evidence of ongoing disinflation leads to higher conviction among central bankers that medium-term core inflation will converge towards target while business-cycle concerns become immediate. At this stage, the pay-off function becomes asymmetric again as it was in the first stage, although it is now inverted; preventing a further slowdown is now prioritized over fighting inflation. Central banks pivot.

Cuts with a hawkish signature

In our base case, these four stages play out well before the end of H1 2023. In the ensuing recession, policy rate cuts will be relatively modest as the convergence of core inflation to the 2% target is slower than anticipated in the wake of the 2023 recession. Afraid to ease excessively (with the post-pandemic inflation surge in mind), the cuts have a hawkish signature and the easing cycle settles around the neutral policy rates. The Fed remains on hold at a 2.5% Fed funds rate while the ECB sticks to a 1% policy rate to weather the choppy recovery phase that follows. This leaves real policy rates in the US around 0% during the projection period, while the eurozone still sees negative real policy rates at around -1.3% on average.

In our bull case, policy rate levels are very similar to the base case, though they start to diverge after 2025 as core inflation drops well below the 2% target because of benign disinflation due to a more flexible supply side (the three sources of inelasticity described in our macro base case fade). Owing to higher productivity, a lower global savings glut (resulting from higher degree of (green) capex and higher consumption growth), lower risk aversion and a lower degree of de-risking in financial institutions, the neutral rate of interest, the rate consistent with trend GDP growth and price stability, is higher compared to the base case. While real policy rates are higher compared to the base case, the Fed has more leeway to support the expansion phase post-2023 compared to the base case because inflation has been brought fully under control.

In our bear case, the four-stage cycle described above compresses in time and a Fed pivot happens earlier compared to the other scenarios. Moreover, given a higher sensitivity to the ongoing growth slowdown, central banks cut rates more deeply during the recession despite core inflation still hovering around 3% in 2023. Thus, central banks stay behind the curve and the sting of inflation is not taken out.

In the following recovery phase, US core inflation regains momentum and eventually hits 4.75% by 2025 as economic growth rebounds to its long-run trend. This clearly starts to worry the Fed and it embarks on an aggressive tightening cycle. Yield curves invert by 2026 as the Fed policy rate hits 4% while other central banks join the hiking action. By 2027, US inflation has leveled off to 3% again (eurozone 2.4%) while a recession hits and modest cuts follow. This double-dip scenario (recession in 2023 and 2027) echoes the experience of the early 1980s when it took Volcker two NBER recessions to get inflation under control.

5.2 Developed government bonds

At the end of June last year, 28.1% of global government bonds had a negative yield-to-maturity. One year later, this is reduced to only 7.1%.[2] These negative yielding government bonds are almost exclusively Japanese government bonds.

2. Source: ICE BofA Global Government Bond Index, Robeco. 30 June 2022.

In theory, long-dated nominal government bonds are considered riskier than cash because of their exposure to real productivity growth risk and inflation risk. Investors would therefore typically demand a term premium as a reward for holding these long-term assets instead of cash. We expect that over the long run, the premium for holding long-dated government bonds is 75 bps over cash, slightly below its historical global average of 100 bps since 1900.

Compared to previous years, the valuation of government bonds has substantially improved. Estimated term premiums are no longer very negative and government bond yields are now above their 10-year averages. However, most bond yields are still below our long-term expectation of 4% for the safest governments, even now that inflation is at elevated levels in many countries. Hence, we still consider government bonds to be expensive, even though they are much less expensive than in previous years.

In our base case economic scenario, policy rates are low in the eurozone and Japan, at 1% and 0% respectively. For the US, we expect policy rates to increase to 2.75% and then settle at 2.5% in five years. We expect UK policy rates to be 0.25%-0.5% below those in the US. Market expectations about future policy rates in combination with risk premiums due to increased inflation volatility determine the path of our 10-year government yields for the major countries. For Germany, we expect bond yields to increase steadily to 1.8% over the next five years. Bond yields for the entire eurozone will be somewhat higher due to credit and liquidity risk.

The 10-year yield in the US is expected to increase to 3.5% before it declines to 2.75% around 2027. This slight increase is consistent with the observation in Smith and Valcarcel (2022) and others while quantitative easing substantially reduced long-term bond yields, an increase in term premiums from quantitative tightening is to be expected. Japanese bond yields are expected to increase marginally and stay below 1% for the entire five-year period. Interest rates in the UK follow those of the US, but at a somewhat lower level. The developments of these government bond yields determine the domestic bond return for each of these major regions.

For the developed government bonds asset class, we hedge the local return of each of these markets into the respective base currencies. The currency hedging cost is the difference in the predicted policy rates, as currency hedging is usually done by rolling short-term derivative contracts. For an investor with euros as their base currency, we then obtain a domestic government bond return of -0.5%, which is the return on German government bonds. We expect developed government bonds to return 1% currency-hedged to euro. For an investor with US dollars as their base currency, we obtain a much higher domestic government bond return of 3.25%, which reduces to 2.5% for the entire developed bond market. This is in part because other bond markets have lower yields, which leads to a local currency return of 1.25%. The policy rate differences with the US lead to a currency hedging gain of 1.25%, leading to the 2.5% return in US dollars.

Both other scenarios are not that different when it comes to government bond returns over a five-year period, even though the interest rate path is expected to deviate between scenarios. In the Silver Twenties scenario, US bond yields peak at 4.5% at the end of 2024 but decrease afterwards to around 3%. German bond yields on the other hand steadily increase to 2.3% five years from now. Even Japanese yields are expected to cross the 1% hurdle in 2025. This leads to developed markets bond returns that are 0.75% and 2.25% when currency hedged to euros and US dollars, respectively. In the Stag Twenties scenario, US bond yields increase to our steady-state assumption of 4% at the end of 2025 but decline to 3.5% over the next two years. German bond yields follow the same pattern, but at a lower level, meaning that the maximum bond yield will be at 1.75%. Japanese bond yields increase slightly but remain well under the 1% hurdle for the entire five-year period. This leads to developed government bond returns of 1.25% and 2.50% when hedged to euros and US dollars, respectively.

5.3 Emerging local currency government bonds

Having notably upgraded our expected return for developed markets sovereign bonds in our base case, will EMD local currency issuers have to compete harder to lure capital inflows as the global search for real yield loses momentum?

The rating of emerging market debt in local currency hovers between investment grade and high yield, with constituents removed from the JP Morgan GBI-EM global index once the rating is A- or above for three consecutive years. In addition to country-specific duration and credit risk, local FX risk needs to be factored into the equation. Currency movements remain an important contributor to overall EMD LC returns even as the

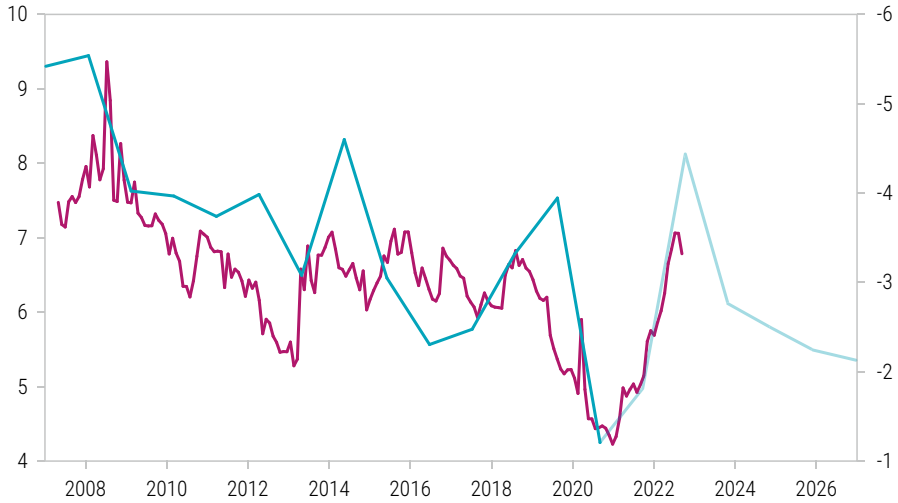
co-movement of annual EM FX returns with the total return of the JP Morgan GBI-EM has become less pronounced since the Covid recovery.

Our base case sees EMD LC struggling to attract inflows into 2023 as central banks in developed markets continue to tighten monetary policy, while the US dollar still contributes to tightening global financial conditions. Besides tightening financial conditions, inflation differentials continue to play a key role in shaping EMD LC returns. At the start of our projection period, we expect inflation differentials to remain elevated in EM versus DM as a result of worsening terms of trade due to decelerating commodity prices in the face of a 2023 recession in the US and food price inflation. The pass-through from the food price-induced inflation shock into interest expenses will be more pronounced in Latin American issuers like Brazil and Chile compared to Asian issuers like China and Malaysia.

The energy crisis instigated by the Russia-Ukraine war keeps the vicious link between fertilizer prices and lower crop yields intact, pushing up global food prices even further (see our special on food insecurity). This hurts real purchasing power in emerging economies, especially emerging market debt issuers that have a high cereal import dependency and relatively low GDP per capita like Egypt. In response, food subsidy programs dent EM government fiscal reserves, worsening debt sustainability. However, the shift observed since last year towards a high inflation regime in emerging markets is a double-sided coin for EMD LC issuers. High inflation also erodes the real debt burden in so far as the nominal GDP is able to outpace the increasing interest rate burden on the outstanding debt, as EM central banks continue to tighten monetary policy in response to the positive inflation shock. Emerging economies with a low share of inflation-linked bonds in their issuance and a high weighted average duration of outstanding debt, could even see an improvement in their real debt dynamics by the end of 2023.

After 2023, inflation differentials start to become more favorable for emerging markets. The recovery in the US gets underway; improving global aggregate demand improves EM current accounts; and EM currencies start to appreciate while the US dollar enters a bear market. With investors anticipating a peak in EM-DM inflation differentials by 2024, EMD LC yields already roll over in 2023 (after an earlier peak observed in DM sovereign bond yields prior to the US recession).

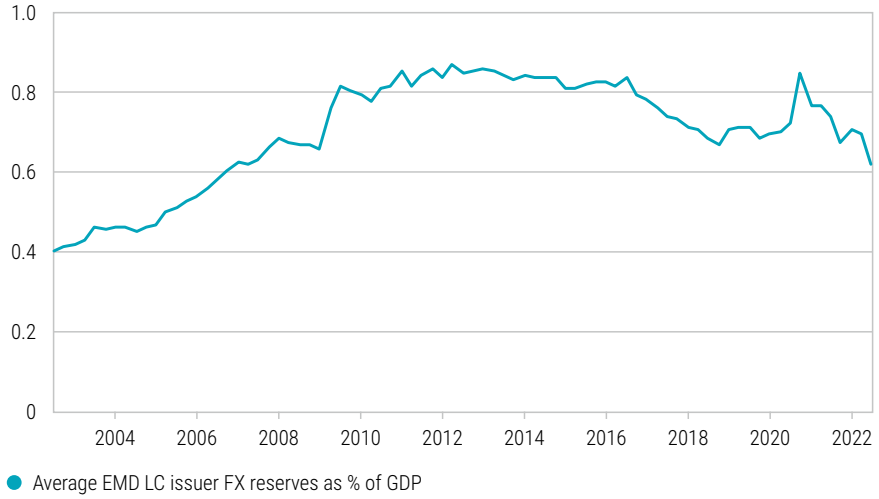
Figure 5.5: Declining inflation differentials EM-DM suggest yield compression ahead



Source: Refinitiv Datastream. Note: light line denotes IMF projection.

The extent of EMD LC yield compression is capped, however, given quantitative tightening by developed market central banks into 2025, keeping required liquidity risk premiums elevated. Amid an improved palette of high carry alternatives (including the US Treasury market), the susceptibility of EMD LC to liquidity shocks increases compared to the pre-Covid era while resilience in the form of FX buffers fades. Competition for external savings increases.

Figure 5.6: Resilience to weather shocks has declined

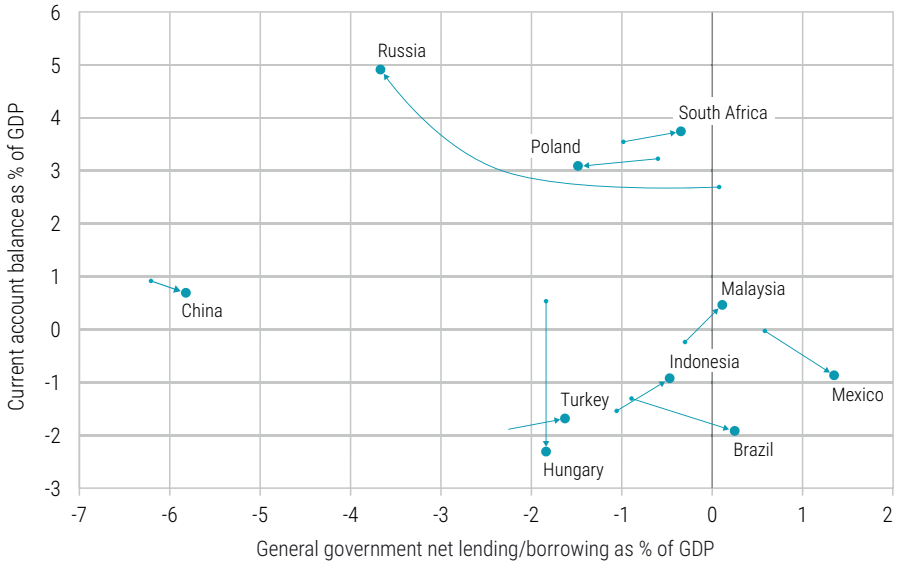


Source: Refinitiv Datastream, Robeco

According to IMF projections for 2023-2027, in addition to more modest yield compression due to increasing competition for global capital flows, some EMD issuers continue to show twin deficits. According to these projections, certain countries, including Hungary, Indonesia and Turkey, will exhibit both a fiscal deficit and a current account deficit in the next five years. Given that the EM growth outlook in our base case is less rosy compared to the IMF forecast, downside risks compared to consensus remain, and investors will not be able to fully harvest the current starting yield of 6.8%.

Lastly, yield compression will also be limited in reflection of higher climate risk in EM. The tug of war between building climate resilience on the one hand and the materialization of climate shocks on the other could tip the balance towards higher risk premiums for higher risk countries. In conclusion, we expect a 2.75% return for EMD LC for a euro investor and a 5.75% return for a US dollar investor in our base case.

Figure 5.7: Only Malaysia heading towards the sweet spot



Source: IMF, Robeco. 5Y averages of 2023-2027 IMF projections.

Figure 5.8: Current account improvement suggests real appreciation of EM FX

Source: Refinitiv Datastream, Robeco

In our bull case, growth differentials as well as inflation differentials for EM versus DM are more favorable compared to the base case. Elements such as the big Covid vaccination rate differential between EM and DM, high consumption volatility due to food price shocks in EM, and a real estate crisis in China which have all required higher risk premiums for exposure to EMD in LC, fade. At the end of 2023, Chinese consumer sentiment rebounds as indications of a domestic real estate market recovery are building (which determines 70% of their wealth), just at a time when Covid immunity is in sight on the back of domestically developed mRNA vaccines. Rebounding Chinese imports bode well for surrounding Asian economies. Current accounts as a percentage of GDP improve as exports surge. In this scenario, the currencies of EMD LC issuers show a real appreciation and the 8.3% average deviation from relative PPP of the top 10 EMD LC issuers fully mean reverts between 2023-2027, adding almost 2% to total return on an annualized basis.

However, as the euro also appreciates in this scenario, EMD LC currency gains for the euro investor are more limited with a total return of 4.25%. Even in our bull case we now foresee upward pressure on EMD yields from an increased competition for international capital and pricing of climate risk, with the latter factor largely uncorrelated with business cycle risk. This has led us to lower the bull case return compared to last year in addition to discounting an environment of receding excess liquidity.

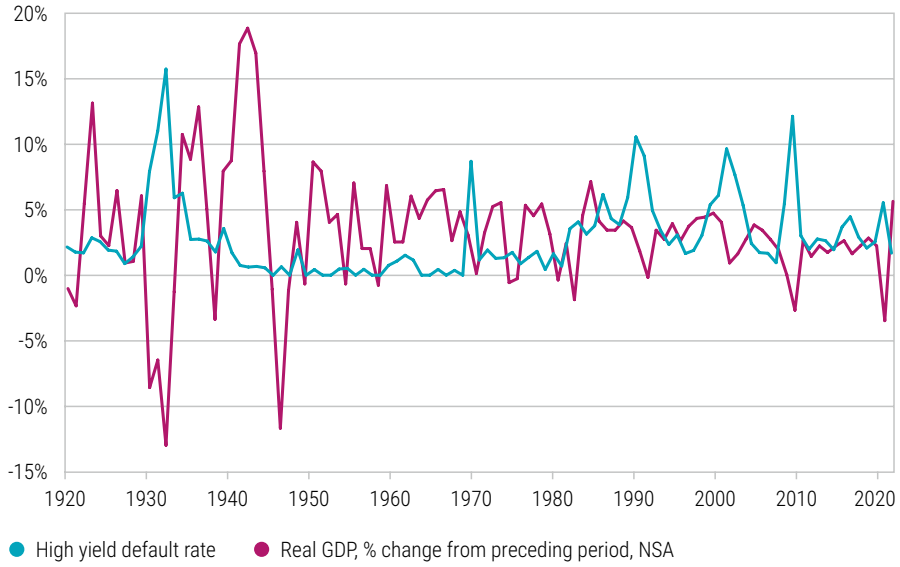
In our bear case, an early Fed pivot initially bodes well for the asset class as the Fed cuts policy rates to 1.5% to mitigate the fallout from a 2023 recession. This triggers a US dollar depreciation and eases financial conditions. However, the 2023 recession fails to cool the US labor market enough to prevent wages chasing prices and core inflation flares up again by 2025. With the Fed embarking on an aggressive second tightening cycle by 2026, EMD in LC yields surge as global financial conditions worsen considerably and a second US recession ensues by 2027. As this recession is deeper compared to the 2023 version, demand destruction is significant. EMD LC yields rise significantly towards the end of the projection period in reflection of deteriorating debt sustainability and elevated political uncertainty as tensions between the US and China reach boiling point. In this case, returns for a euro-based investor will be 0.5%.

5.4 Corporate bonds

Corporate bonds pay investors a premium over government bonds to compensate them for the credit and liquidity risk that the asset class involves. The outlook for investment grade credit in our base case scenario from a macroeconomic perspective is negative because we expect a recessionary period in the next couple of years. Spreads have widened substantially since last year and are now slightly above their historical median levels. This suggests that corporate bond markets are already pricing in a slowdown. However, current spreads are too low to fully reflect that there is a recession period around the corner. This is the reason that our expected credit risk premium is close to the long-run average, despite the attractive valuation signal.

Our expectation of higher-than-usual default rates motivated by the long-run empirical evidence on high yield default rates after World War I. Figure 5.9 shows that when real GDP growth is negative, in many instances the default rate increases, sometimes close to or even above 10%. Our forecast of a recession with a few quarters of negative real GDP growth foreshadows an elevated default rate. This may be exacerbated by the higher prevalence of 'zombie firms'. These are loosely defined as firms that are unable to cover debt-servicing costs from current profits over an extended period. Banerjee and Hofmann (2018) find that weak banks that prefer to roll over bad debt rather than writing it off, combined with the low interest rate environment, have created a larger pool of zombie firms across developed markets. Increased interest rates and credit spreads may force some of these zombie firms into bankruptcy. According to McGowan, Andrews, and Millot (2018), the advantage of such a shake-out is that capital and labor can be allocated more productively to firms with higher productivity.

Figure 5.9: High yield default rates and GDP growth



Source: FRED, Moody's, S&P, Maddison Project Database 2020 (Bolt and Van Zanten 2020). High yield default rates: Moody's (1920-2017), S&P (2018-2021).

In our base scenario, we expect credit spreads to widen a little more before they come back to historical median levels. In combination with default rates historically seen for recession periods in the first years, this means that excess returns for credits are close to the historical average. We expect that corporate bonds issued by US firms will perform somewhat better than those issued in the eurozone, as the latter is more vulnerable to energy shocks.

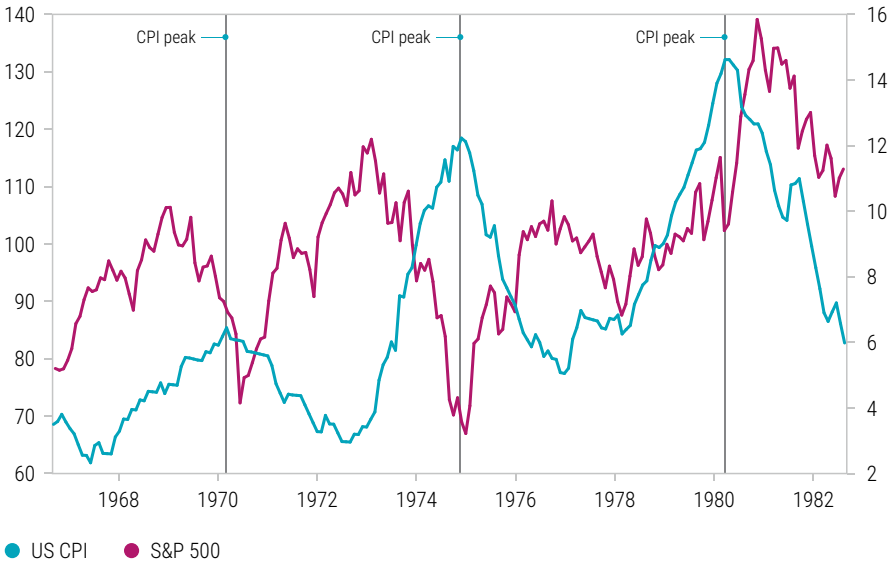
For an investor with euros as their base currency, we expect a total return of 1.75% on a global investment grade portfolio. This is 75 bps above the expected return for a developed government bond investment, which is in line with the steady-state excess return for investment grade corporate bonds. For high yield bonds, we expect a total return of 2.75% per year for the coming five-year period. The excess return is 175 bps, on par with the steady-state assumption of 175 bps of additional return for this asset class. For investors with US dollars as their base currency, the level of returns is substantially higher, but the premiums are similar. The expected return for global investment grade credits is 3.25%, and for global high yield 4.25%. These are excess returns of 75 bps and 175 bps compared to developed government bonds. However, note that since we expect US government bonds to return especially well with 3.25%, the excess return compared to relatively risk-free assets is small.

The Silver Twenties scenario is somewhat better for investment grade corporate bonds compared to the base case. Whereas the expected return of government bonds decreases due to higher interest rates, the expected return for corporate bonds increases slightly. This suggests somewhat lower defaults and a slight spread tightening for this scenario. The Stag Twenties scenario is slightly worse for corporate credits. In this scenario spreads are above median twice during the first and second recession over this five-year period, but we expect default rates to end up in the highest historical quartile.

5.5 Equities

Since mid-June a countertrend rally in equity markets bode some relief after a very turbulent first half of 2022 that saw equity markets plunge into bear market territory. The current bear market has created more attractive entry points and opportunities. The path of inflation remains key for equity markets as big market turnarounds have often been observed around inflation peaks, especially in high inflation episodes like the 1970s and early 1980s. For instance, the S&P 500 troughed in June 1970 after inflation peaked in February 1970; in December 1974 following a November 1974 peak; and in April 1980 coinciding with a peak in that same month.

Figure 5.10: During high inflation episodes, equity markets trough around cyclical inflation peaks

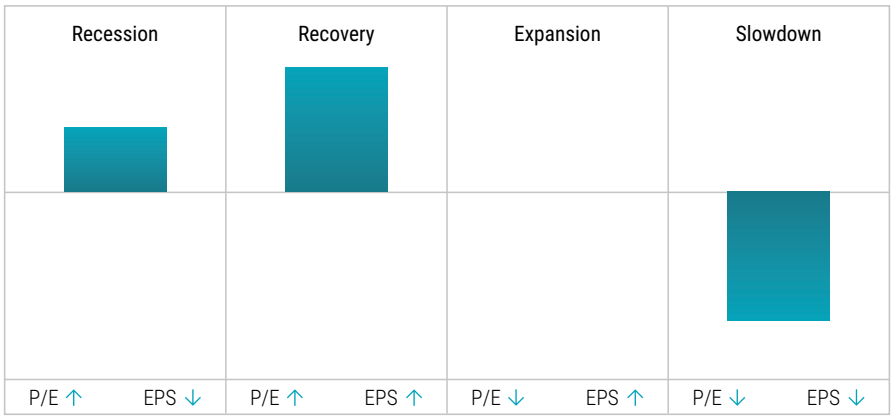


Source: Refinitiv Datastream, Robeco

Signs of inflation peaking in H2 2022 are increasing as supply constraints ease, while the inflationary impulse of commodity, agriculture and core goods prices is fading. In addition, equity markets typically lead the business cycle and had by the end of June 2022 already been fully discounting a mild recession. Downside risks are still present, however, as reflexivity in current inflation dynamics could cause inflation to peak later than expected, necessitating further tightening of financial conditions by central banks. Subsequently, this could make a potential recession, a risk being flashed by the 2s10s segment inversion of the US Treasury yield curve in April 2022, less benign than currently anticipated. In short, while downside risks linger, the near-term risk-reward balance for equities has become more favorable in light of disinflation ahead.

Looking beyond the current volatility, what could be in store for equity markets in the next five years? In terms of the equity market cycle, we are in a late expansion phase that has been dominated by multiple compression while earnings growth is still holding up.

Figure 5.11: P/E and EPS during different phases of the business cycle



Source: Robeco

The equity market cycle

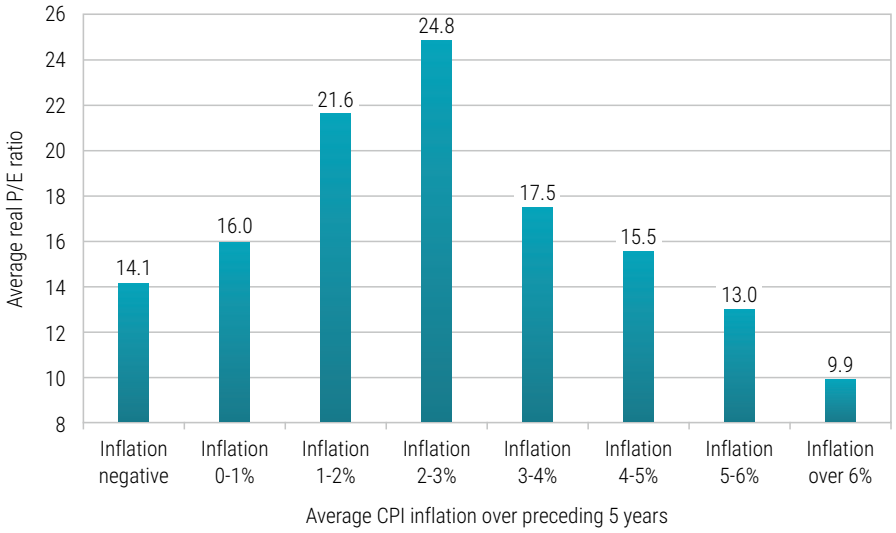
In last year's publication, we called for multiple compression in excess of 30% on a cumulative 5-year horizon, predicated on the view that high starting multiples (P/E >20) in conjunction with negative real rates have historically seen big downward shifts in multiples. Since publication last September, we already observed a decline in the S&P 500 price-earnings ratio of 32% by mid-June 2022. So, is the derating process we predicted already completed for the medium term?

The short answer is no. We maintain that the majority of the observed multiple compression last year is predominantly of a cyclical nature due to the transition of the equity market from the expansion phase, in which multiples contract but earnings growth still contributes positively to total equity return, to the early slowdown phase in the equity cycle, in which both earnings growth as well as price-earnings ratios start to decelerate. Looking ahead, there are three emerging secular trends that put downward pressure on multiples, irrespective of where we are in the cycle.

Three secular headwinds for multiple expansion

Recalibrating the secular outlook by incorporating the latest developments, we suspect we're not done yet with multiple contraction and imagine that the cyclically adjusted price-earnings ratio for the S&P 500 will now settle around 21 from its current level of 29 by the end of 2027. This is close to the 40-year average Shiller CAPE. We did not foresee the Fed getting this far behind the curve, reflected by the largest increase in developed market bond yields of the past 40 years. With inflation and in reflection nominal interest rates having now shifted towards a higher level, remaining above 3% in 2023, in our base case compared to last year, the subsequent higher nominal discount rate warrants a lower terminal price-earnings ratio. The historical distribution of equity valuations also shows S&P 500 valuation levels are typically lower in higher inflation regimes.

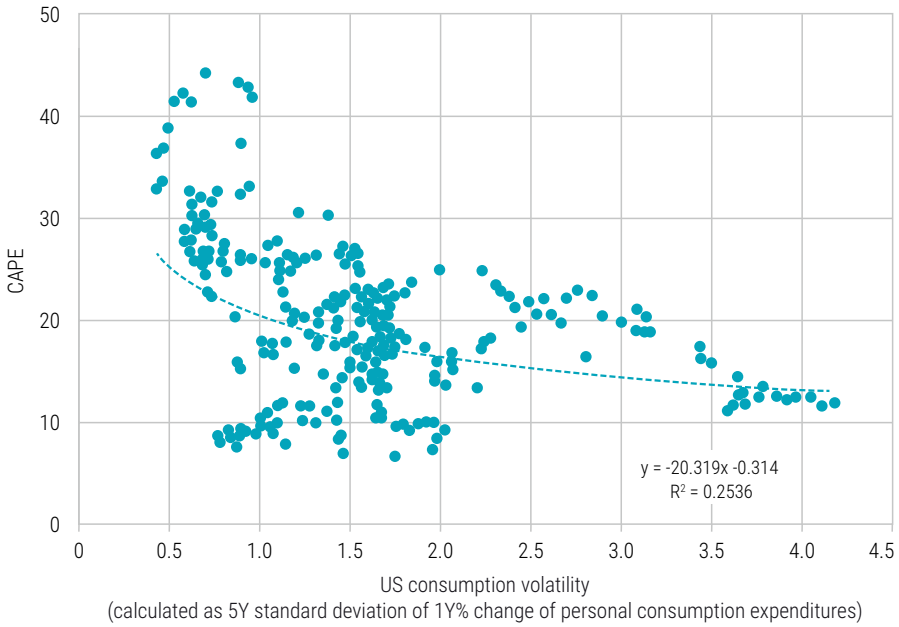
Figure 5.12: Shiller P/E ratio in different inflation environments



Source: Refinitiv Datastream, Robeco, Shiller. Period 1922-2021.

Secondly, there is another secular argument to be made that suggests investors could be demanding they pay less for future cashflows, precisely because these cashflows might become more volatile. As Ang (2014) and Bansal and Yaron (2004) point out, consumption volatility is a risk factor that matters for equity pricing. As we have shown in the macro section, consumption volatility within a five-year window has surged in developed economies from below 1% to 6% since the start of the pandemic and has not shown signs of easing. Instead, we enter a high consumption volatility regime in our base case as we observe a shift in consumption preferences (from services to goods) and a higher frequency of shocks that impact consumption growth. The resulting uncertainty about future cashflows requires investors to demand higher ex ante risk premiums for allocating to equities.

Figure 5.13: Shiller P/E and US consumption volatility



Source: Refinitiv Datastream, Robeco, Shiller. Period 1951-Q1 tot 2022-Q2.

Thirdly, financial conditions are key in gauging where equity multiples might be heading. The big regime shift facing equities today is the transition from a QE to a QT regime. There is evidence that balance sheet normalization tightens financial conditions and that the effects of QT are not just a simple mirror image of QE (Smith and Valcarel 2022).[3] In fact, the liquidity impact from QT could be double that of QE, judging from the 2017-2019 QT episode according to this study. In our base case, the Fed will have reduced the balance sheet by 20% by the end of 2024 with that shrinkage amounting to USD 95 billion per month from September 2022 onwards. This source of additional tightening of financial conditions equates to 50-75 bps of conventional policy rate tightening, according to the NY Fed.[4]

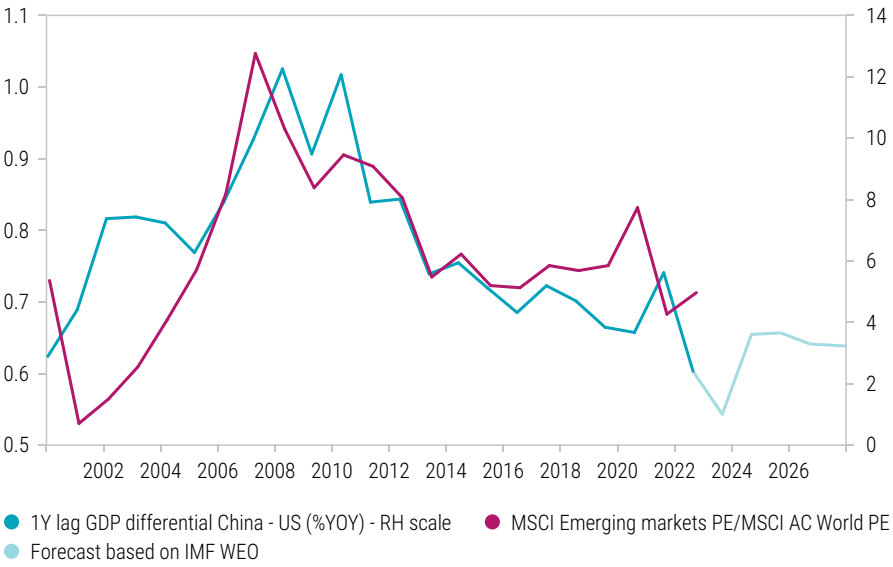
3. https://www.kansascityfed.org/research/research-working-papers/financial-market-effects-unwinding-fed-reserve/

4. https://www.federalreserve.gov/econres/notes/feds-notes/substitutability-between-balance-sheet-reductions-and-policy-rate-hikes-some-illustrations-20220603.htm

The good news is that equity market multiples already fully reflect the intended baseline balance sheet shrinkage back to pre-Covid levels. However, additional downside risks materialize in our base case as firstly, the market hasn't already discounted the asymmetry that will become apparent between QE and QT. Secondly, QT will happen at a higher pace compared to the 2017-2019 episode, aggravating the negative liquidity impact through shrinking bank reserves. Thirdly, in contrast to 2017-2019, the Fed is now joined in its balance sheet contraction by other central banks, with the joint balance sheet contraction lowering global excess liquidity at a faster clip.

China has been leading the post-pandemic recovery and therefore also saw domestic excess liquidity disappearing in early 2021 as nominal GDP growth started to outpace M1 money growth. In response, after the cyclical peak in the EM price-earnings ratio in February 2021, it has declined from 22.7 to 12.5 at the time of writing; a drop of 45%. In short, the derating process for EM seems more mature from a cyclical perspective compared to DM. The current price-earnings discount is above historical averages. Yet, also here secular headwinds will increase and the discount is there for a sound reason.

Figure 5.14: EM versus DM and GDP growth differential

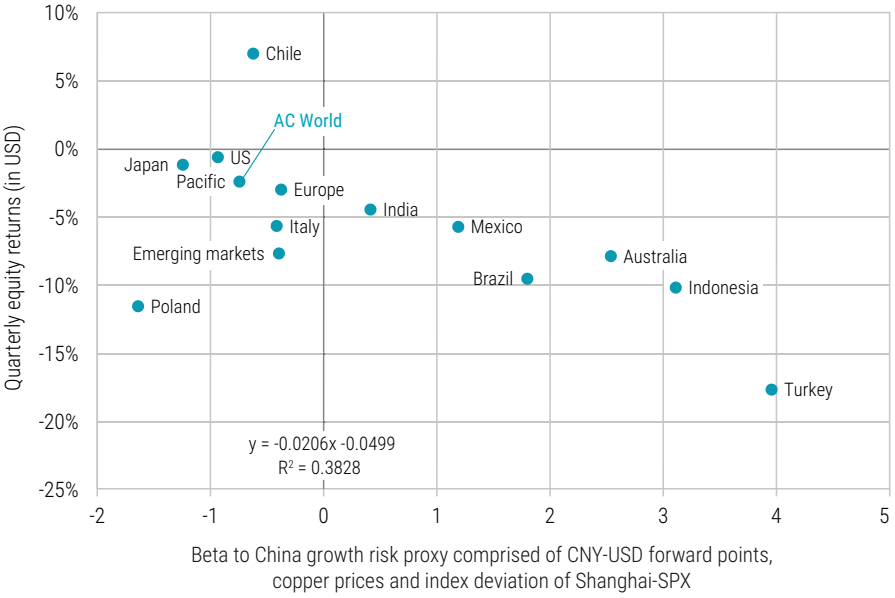


Source: Refinitiv Datastream, Robeco

Markets discount expected GDP growth differentials in relative valuations one year ahead. The expected deceleration in GDP growth differentials EM versus DM – with the underlying key assumption that China won't see greater than 4.5% real GDP growth geometrically annualized between 2023-2027 – will inhibit in our base case multiple expansion of EM versus DM, and will even see a marginally larger EM-DM discount by 2027. The widening discount does not amount to a bearish view on EM. Instead, our view of a weakening US

dollar, peaking DM yields and stronger fiscal support for Chinese households in the next five years bodes well for emerging market equity outperformance, especially for US dollar investors. Within the EM universe, countries with a relatively low sensitivity to Chinese specific growth risk could outperform the benchmark.

Figure 5.15: MSCI country sensitivity to China growth risk

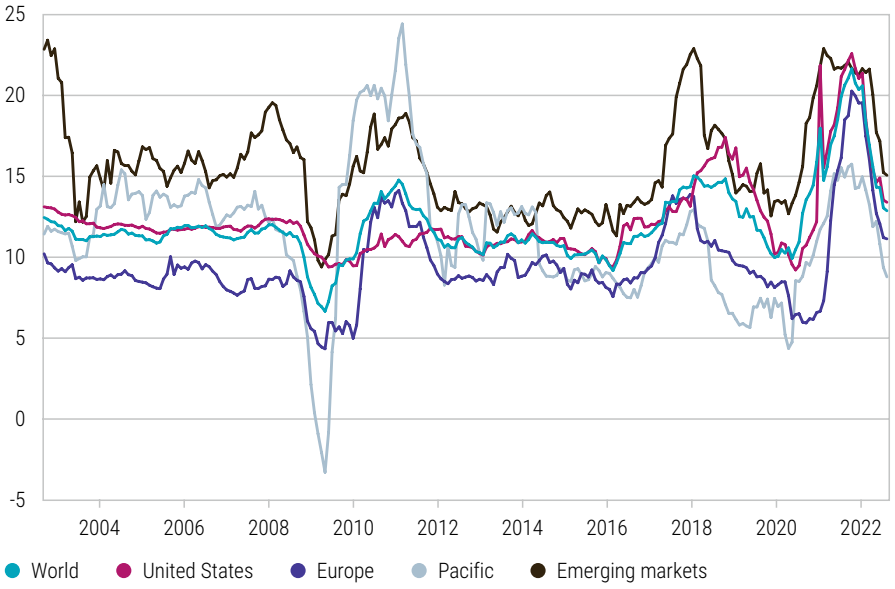


Source: Refinitiv Datastream, Robeco

Earnings outlook: a flatter earnings recovery post-2023

Corporate analyst five-year EPS growth projections seem too upbeat in our base case. The actual forecast of 13.5% EPS growth annualized for the US implicitly assumes that US real GDP expands at a 3% annualized rate for the next five years, while our base case only sees 1.75% real US GDP growth, holding operational corporate leverage constant.

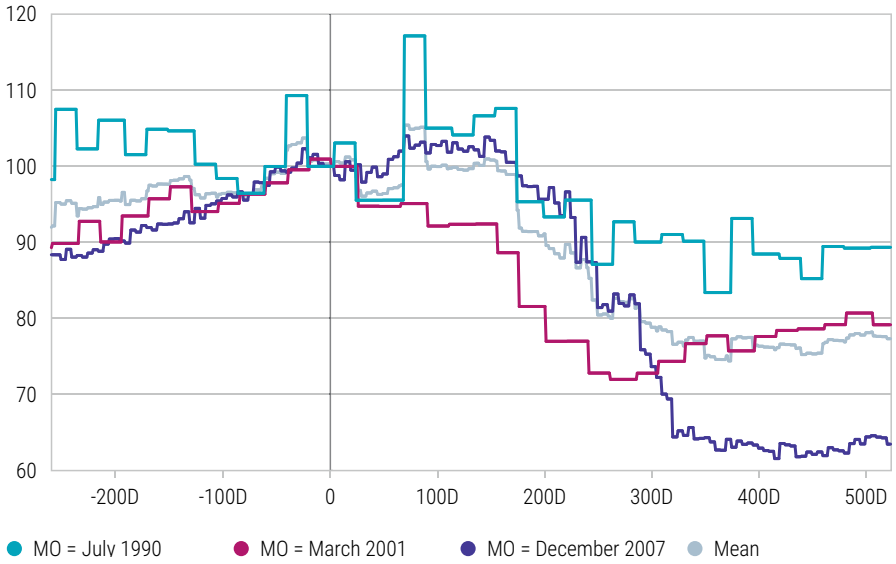
Figure 5.16: 5-year consensus EPS forecast



Source: Refinitiv Datastream, Robeco

As the 2023 recession we expect draws closer, evidenced by the ISM dropping below 50, the subsequent Fed pivot arrives too late to avert an earnings recession. Whenever the leading US manufacturing confidence ISM indicator dips below 50, a bi-quarterly contraction in S&P 500 EPS growth has followed nine months later, with very few exceptions. In the last three NBER recession cycles, earnings declined 25% from peak to recession trough and we expect history to rhyme here, especially given historically stretched profit margins at the start of the next earnings recession.

Figure 5.17: Earnings growth trajectory around recessions



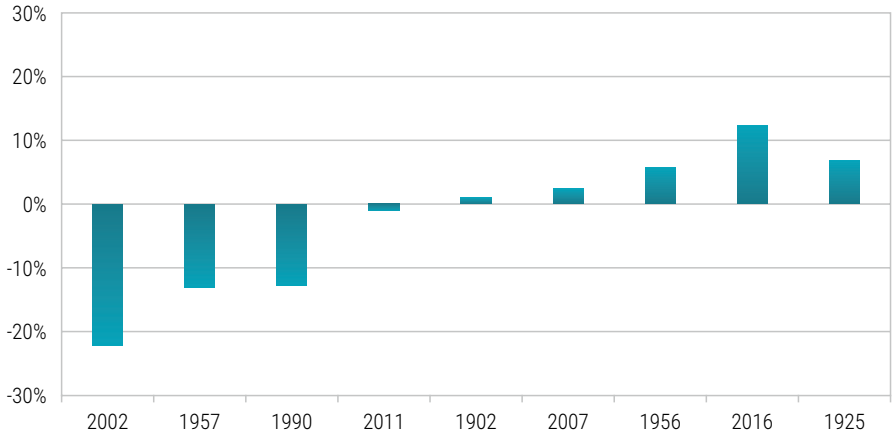
Source: Refinitiv Datastream, Robeco

After 2023, an earnings recovery will slowly emerge, with the earnings rebound notably flatter compared to the post-pandemic recovery in the absence of comparable levels of fiscal as well as monetary thrust, increased corporate taxation, and relatively high unit labor costs capping profit margin expansion.

We notably upgraded our expected developed equities dividend yield in our base case projection to 3%. In elevated inflation regimes, dividend yields have tended to be higher as well. This is partly the flipside of the lower multiples we discussed earlier matching higher inflation episodes (and thus the higher earnings yield we expect to see at the end of the projection period), and partly because we envisage a higher pay-out ratio. With CFOs moving towards more defensive strategies focusing on cost-cutting in a higher volatility environment, we see capex towards expansionary strategies receding, with a larger share of earnings redistributed to shareholders. All in all, we expect a total equity return of 4% annualized for a euro investor. A US dollar investor benefits from appreciation of foreign currencies versus the US dollar and sees a 7.25% return (unhedged). A 4% equity return estimate implies a below steady-state excess return on equities versus cash. For the first time since 2012 we now expect an insufficient reward for taking equity risk compared to what is warranted by the steady-state excess equity return of 3.5% versus cash.

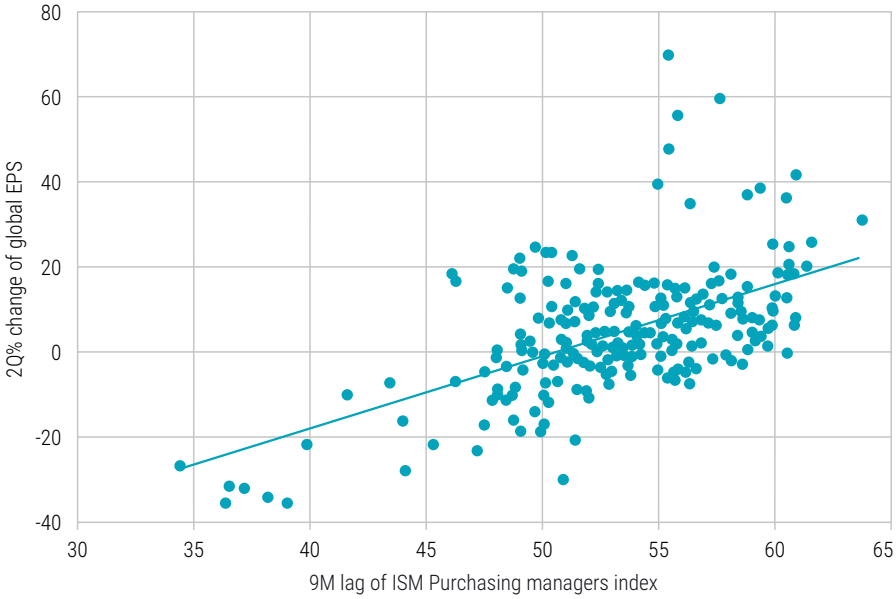
With the re-emergence of inflation, the era of QE-fueled asset price inflation has ended, and with it the TINA narrative is exhausted. Our 3% excess equity return versus cash is still a relatively upbeat return, however, when comparing historical realized excess equity returns in similar macro environments, namely US real GDP growth between 1.5-1.75% and inflation at more than 2%. The median excess equity return of the nine calendar years with similar parameters since 1900 as set out by our macro base case was 1.1%.

Figure 5.18: Excess global equity return versus cash in calendar years of real GDP growth (1.5-2%) and inflation > 2%



Source: DMS database (2017), Robeco

Figure 5.19: A Fed pivot could be too late to avert earnings recession



Source: Refinitiv Datastream, Robeco. Period 2002-2022.

In our bull case, the recent energy, climate and geopolitical shocks prove to have a silver lining for the supply side of the economy. They result in lower unit labor costs and higher productivity, sustaining above-trend corporate profitability, even in the wake of a mild recession by 2023. With consumer ability and willingness to spend surging back above trend levels by 2024 without exerting strong demand-pull inflation because of a more elastic supply side of the economy, equity market volatility remains subdued. Because of lower levels of risk aversion compared to the base case, dividend yields are lower as capex intensity is higher and pay-out ratios fall. In addition, earnings yields are lower as well, as there is a reduced degree of multiple compression. We expect a 9.25% return for developed market equities for a euro investor. High beta regions like emerging market equities outperform.

In our bear case, central banks fail to eliminate the root of inflation by cutting policy rates too aggressively in the next recession. Markets quickly recognize the inflation bias of

central banks and as real interest rates become deeply negative again, overly accommodative central banks reignite an episode of strong asset price reflation. This asset price reflation is driven by growth stocks, given an extremely sluggish economic growth environment in which the scarcity premium for stocks that do generate high earnings growth is bid up against a favorable discount rate environment for stocks with high cashflow duration. By the end of 2025, central banks realize they are behind the curve again and embark on a more aggressive hiking cycle, realizing a deeper recession is needed to tame inflation. The 2027 recession proves to be highly disinflationary given a large degree of excess tightening by central banks in 2026. Developed equity markets bear the brunt in these years, ending 2027 with a five-year annualized -2.5% return for a euro-based investor.

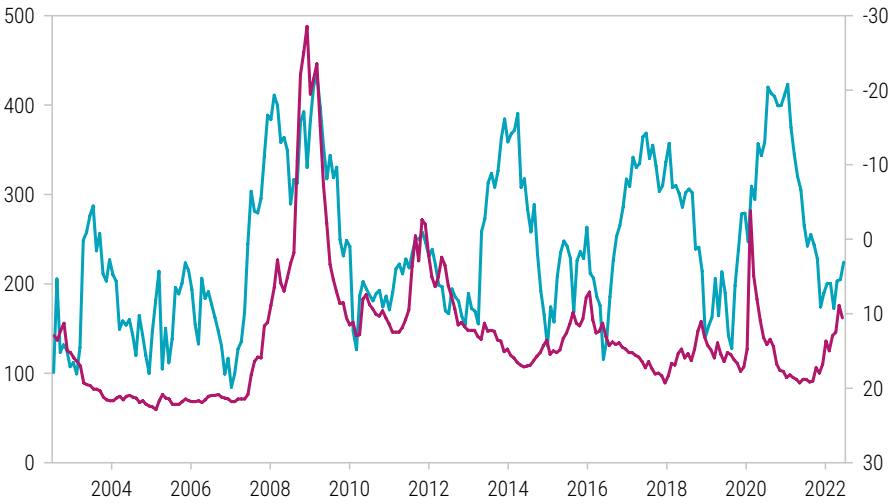
5.6 Real estate

In our base case, the quest for enhanced diversification among investors could benefit a heterogeneous asset class like REITs, as the tide of global excess liquidity recedes on the back of ongoing monetary tightening into 2023. In addition, as the TINA narrative is increasingly challenged, investors are likely to tactically shift down the risk curve, looking for asset classes that have a lower beta that still offer decent excess return potential over Treasuries as long as the expansion remains on track. Furthermore, investors will be on the lookout for assets that maintain pricing power. Even as the sting is taken out of the current inflation dynamics by central banks further down the road, inflation remains above 2% in our base case in the next five years.

Around the 2023 recession, however, we expect REITs to underperform equities. While the general perception is for REITs to be a defensive asset class, judging from the significant positive correlation with relative cyclicals/defensive performance REITs behave more like a cyclical asset in practice and therefore have a high beta to economic activity, which leaves them vulnerable to economic contractions, especially those that morph into recessions.

Underperformance versus equities coincides with but is not limited to blow-outs in investment grade spreads which is not surprising, given the average BBB rating profile of renters.

Figure 5.20: Peaks in investment grade spreads often coincide with troughs in REITs versus global equities performance



Source: Refinitiv Datastream, Robeco

While financing costs are expected to increase for this asset class in the following years, we judge that this will be a gradual process. The extension of debt maturities during the recent years of exceptionally low interest rates has lowered the susceptibility to a sudden surge in financing costs while the resilience to higher interest burdens remains decent, given underlying steady cashflow generation. We expect a 3.75% return for the asset class in euro.

In our bull case, we expect REITs to outperform equities. With the global economy expanding at a healthy pace after the 2023 slowdown and inflation well behaved at around 2%, this asset class typically benefits. Office REITs, still 20% below pre-pandemic level, roar back, and as a whole REITs see a return of 9.75% in euro.

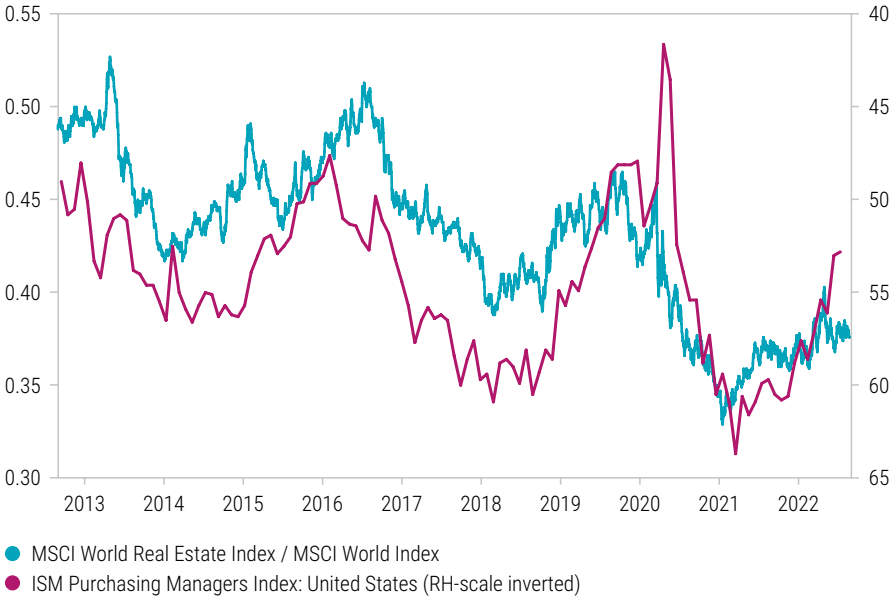
Table 5.2: 1M relative performance MSCI Global REITs versus MSCI World

	ISM					
CPI	< 40	40-45	45-50	50-55	55-60	> 60
< 2%	0.07%	-0.76%	-0.09%	-0.68%	-0.12%	-1.95%
2-3%	-	0.22%	-0.95%	-0.16%	-0.22%	0.83%
> 3%	-7.45%	1.81%	-0.28%	0.05%	0.73%	1.78%

Source: MSCI, Refinitiv Datastream

In our bear case, which pencils in two recessions within 2023-2027, the higher degree of leverage in REITs and their high growth sensitivity compared to equities wreaks havoc especially towards the end of the projection period when the Fed sees no other way out than to engineer a deeper recession to contain rampant inflation. REITs eye a geometrically annualized return of -3.5% in this scenario.

Figure 5.21: Slowing macro momentum during economic expansion typically helps REITs outperform



Source: Refinitiv Datastream, Robeco

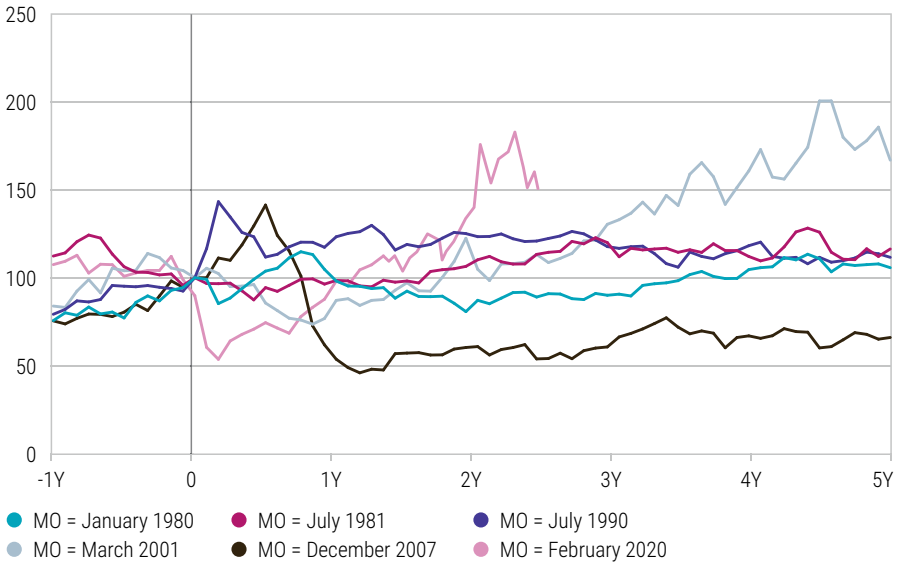
This return pattern confirms the consensus view that REITs are a more defensive play with inflation hedging capabilities. Indeed, the relatively low beta of 0.72 with developed equities corroborates this view and suits investor preference for enhanced diversification.

5.7 Commodities

Commodities have been on a tear in the last two years. As a matter of fact they are the only asset class where we have been predicting excess returns compared to steady-state returns in the past year. What we didn't pencil in, though, was another upward leg since August 2021, with the GSCI commodities index now up 50% since the recession peak in February 2020. Commodity momentum has cooled since mid-June as cracks in global aggregate demand became more pronounced, with the focus shifting from inflation worries to recession risk, while markets started to discount a swifter path for disinflation on the back of the aggressive 75 bps-policy moves by the Fed. Stabilizing medium-term US inflation expectations also typically lowers demand for commodities as an inflation hedge.

So far, realized returns in the post-pandemic expansion are already largely on par with those achieved at the end of the 2001 commodities supercycle.

Figure 5.22: GSCI commodities rebased to last six recession peaks



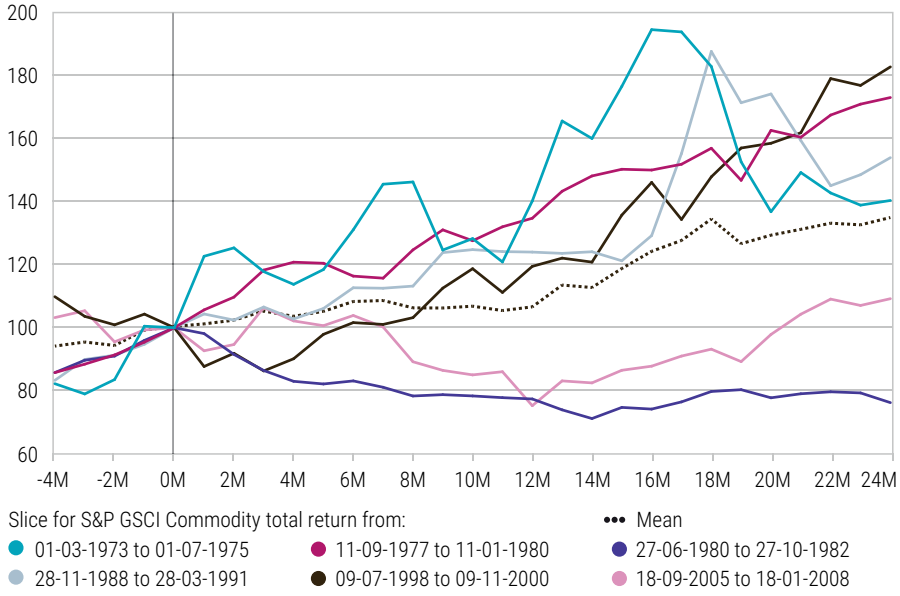
Source: Refinitiv Datastream, Robeco

Does this imply that the commodity supercycle of the Roasting Twenties is already over? Looking ahead, we anticipate steady state-like returns of 4% for commodities in our base case over the next five years.

Firstly, as discussed in our macro chapter, we observe relatively inelastic supply in commodity markets. With tight spot markets, demand destruction through high prices will be the main rebalancing mechanism in the next few years. Consumer demand destruction is already underway, with consumers actively rationing their energy consumption. This rationing process typically reaches its zenith when gasoline prices peak ahead of a recession. These surged in the US because crack spreads (the difference between a barrel of crude oil and the petroleum products refined from it) have widened on the back of refinery closures and disruptions, raising prices for consumers.

Secondly, though yield curve inversions have flagged recession risk in the US, commodities are a late-cycle play that on average see rising prices between yield curve inversion and peak recession. A surging energy bill will bring forward a eurozone recession, especially if Nord Stream 1 is fully closed off to German customers by Russia. Increased global competition for LNG will be the result, as Europe tries to wean itself off Russian gas and gain energy independence in the coming years.

Figure 5.23: Commodities around yield curve inversion

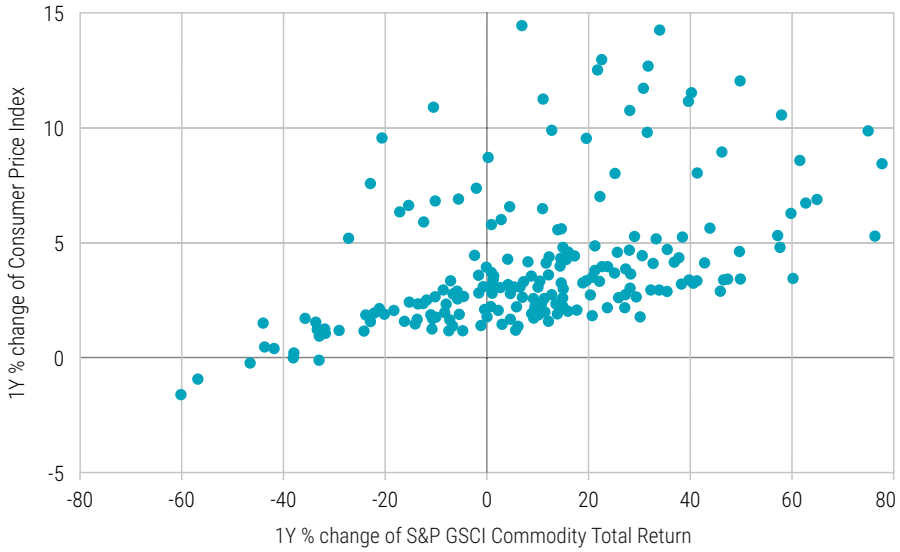


Source: Refinitiv Datastream, Robeco

Thirdly, as we describe in more detail in our '(No) Food for Thought' special topic, rising food prices could continue beyond the next harvest season. Rising gas prices boost fertilizer prices which lower crop yields, not only this year but in the medium term, and the soil becomes further depleted. In addition, a protracted war in Ukraine could inhibit cereal production even if the recent deal signed by Ukraine and Russia on wheat exports through the Black Sea holds.

Fourthly, with our five-year US inflation projection at 2.6%, modestly above five-year breakeven inflation levels, we see demand for commodities as an inflation hedge persisting. While recessions, which we do expect around 2023, are typically highly disinflationary and as such create headwinds for the asset class, we do not envisage outright deflation in our base case, or deep commodity bear markets.

Figure 5.24: CPI and commodities; commodity bear markets have seen CPI below 1.25%



Source: Refinitiv Datastream, Robeco. Period 1948-2022.

In our bull case, the case for commodities is even more compelling because developed markets continue to grow above their long-term trend rate, with aggregate demand able to sustain higher prices for longer. A lower inelasticity of supply compared to the base case (also as costs of capital for miners and oil producers decline as a result of an accelerated green transition) contributes to a rebalancing in commodity markets. With the supply side contributing, price rises are less explosive and more sustainable as a result.

Our Roasting Twenties theme published last year comes to the fore in our bull case. With countries representing around 67% of global GDP having committed themselves to solving climate change, we expect a policy-driven push to speed up the green energy transition and in the wake of this, demand for 'green metals' like copper, iron ore and aluminum will increase. Steel is the biggest input for windmill producers with around 84% of each turbine's weight consumed by steel. According to the IEA, an offshore wind plant requires nine times more mineral resources than a gas-fired plant, while the typical electric car requires six times the mineral inputs of a conventional car. Electrification requires huge amounts of copper and aluminum.

To facilitate the renewable energy transition, there will be a lot of roasting, i.e. smelting of iron ore, copper and alumina, in coming decades. To meet the net-zero carbon emission target by 2050, six times more mineral and metal inputs are required compared to today's inputs into renewables. Our bull case sees a green transition-inspired supercycle prolonged and generates a 8.25% projected return in the next five years.

In our bear case, commodities suffer from a fall in aggregate demand around the 2023 recession, despite safe haven flows benefiting gold after the Fed hits its peak policy rate. As supply remains relatively inelastic and the rising cost of capital inhibits expansion of mining supply, the rebalancing between supply and demand is predominantly achieved by demand destruction. After some respite around 2024/2025 for commodities as a recovery takes hold, a second policy-tightening cycle to contain resurging inflation reverses the rebound. Eyeing an even deeper phase of demand destruction in 2027 compared to 2023, commodities see an overall return of -2% in euro in the next five years.

5.8 Summary

We provide a full overview of our expectations for the main asset classes in our base case scenario in the introduction to this chapter. Here, we show these returns and also our expectations for asset class returns in the two other scenarios, both for euro and US dollar investors. We can see that in our 'Silver Twenties' scenario we expect further high returns for risky asset classes, whereas our 'Stag Twenties' scenario would see negative returns for most riskier asset classes, at least for a euro investor. ●

Table 5.3: Five-year return forecast for three macroeconomic scenarios

	Expected Returns 2023-2027 (EUR)				Expected Returns 2023-2027 (USD)		
	Bull	Base	Bear		Bull	Base	Bear
Bonds							
Domestic cash	1.00%	1.00%	1.25%		2.50%	2.50%	2.50%
Domestic bonds	-0.75%	-0.50%	0.50%		3.25%	3.25%	2.75%
Developed	0.75%	1.00%	1.25%		2.25%	2.50%	2.50%
Emerging debt	4.25%	2.75%	0.50%		7.00%	5.75%	4.00%
Corporate inv grade	2.00%	1.75%	0.50%		3.50%	3.25%	1.75%
Corporate high yield	3.75%	2.75%	0.25%		5.25%	4.25%	1.50%
Equity							
Developed	9.25%	4.00%	-2.50%		12.00%	7.25%	1.00%
Emerging	11.75%	5.25%	-2.75%		14.50%	8.25%	0.75%
Real estate	9.75%	3.75%	-3.50%		12.50%	6.75%	0.00%
Commodities	8.25%	4.00%	-2.00%		11.00%	7.00%	1.50%
CPI							
Inflation	2.00%	2.25%	2.75%		2.00%	2.75%	3.75%

Source: Robeco. September 2022. Returns are geometric and annualized.

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The Fund may not be offered or sold to the public in Brazil. Accordingly, the Fund has not been nor will be registered with the Brazilian Securities Commission (CVM), nor has it been submitted to the foregoing agency for approval. Documents relating to the Fund, as well as the information contained therein, may not be supplied to the public in Brazil, as the offering of the Fund is not a public offering of securities in Brazil, nor may they be used in connection with any offer for subscription or sale of securities to the public in Brazil.

Additional Information for investors with residence or seat in Brunei

The Prospectus relates to a private collective investment scheme which is not subject to any form of domestic regulations by the Autoriti Monetari Brunei Darussalam ("Authority"). The Prospectus is intended for distribution only to specific classes of investors as specified in section 20 of the Securities Market Order, 2013, and must not, therefore, be delivered to, or relied on by, a retail client. The Authority is not responsible for reviewing or verifying any prospectus or other documents in connection with this collective investment scheme. The Authority has not approved the Prospectus or any other associated documents nor taken any steps to verify the information set out in the Prospectus and has no responsibility for it. The units to which the Prospectus relates may be illiquid or subject to restrictions on their resale. Prospective purchasers of the units offered should conduct their own due diligence on the units.

Additional Information for investors with residence or seat in Canada

No securities commission or similar authority in Canada has reviewed or in any way passed upon this document or the merits of the securities described herein, and any representation to the contrary is an offence. Robeco Institutional Asset Management B.V. relies on the international dealer and international adviser exemption in Quebec and has appointed McCarthy Tétrault LLP as its agent for service in Quebec.

Additional information for investors with residence or seat in t he Republic of Chile

Neither Robeco nor the Funds have been registered with the Comisión para el Mercado Financiero pursuant to Law no. 18.045, the Ley de Mercado de Valores and regulations thereunder. This document does not constitute an offer of or an invitation to subscribe for or purchase shares of the Funds in the Republic of Chile, other than to the specific person who individually requested this information on their own initiative. This may therefore be treated as a "private offering" within the meaning of article 4 of the Ley de Mercado de Valores (an offer that is not addressed to the public at large or to a certain sector or specific group of the public).

Additional Information for investors with residence or seat in Colombia

This document does not constitute a public offer in the Republic of Colombia. The offer of the Fund is addressed to fewer than one hundred specifically identified investors. The Fund may not be promoted or marketed in Colombia or to Colombian residents, unless such promotion and marketing is made in compliance with Decree 2555 of 2010 and other applicable rules and regulations related to the promotion of foreign Funds in Colombia.

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Additional Information for investors with residence or seat in Germany

This information is solely intended for professional investors or eligible counterparties in the meaning of the German Securities Trading Act.

Additional Information for investors with residence or seat in Hong Kong

The contents of this document have not been reviewed by the Securities and Futures Commission ("SFC") in Hong Kong. If there is in any doubt about any of the contents of this document, independent professional advice should be obtained. This document has been distributed by Robeco Hong Kong Limited ("Robeco"). Robeco is regulated by the SFC in Hong Kong.

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The Management Company is not making any representation with respect to the eligibility of any recipients of the Prospectus to acquire the Shares therein under the laws of South Korea, including but not limited to the Foreign Exchange Transaction Act and Regulations thereunder. The Shares have not been registered under the Financial Investment Services and Capital Markets Act of Korea, and none of the Shares may be offered, sold or delivered, or offered or sold to any person for re-offering or resale, directly or indirectly, in South Korea or to any resident of South Korea except pursuant to applicable laws and regulations of South Korea.

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Additional Information for investors with residence or seat in Malaysia

Generally, no offer or sale of the Shares is permitted in Malaysia unless where a Recognition Exemption or the Prospectus Exemption applies: NO ACTION HAS BEEN, OR WILL BE, TAKEN TO COMPLY WITH MALAYSIAN LAWS FOR MAKING AVAILABLE, OFFERING FOR SUBSCRIPTION OR PURCHASE, OR ISSUING ANY INVITATION TO SUBSCRIBE FOR OR PURCHASE OR SALE OF THE SHARES IN MALAYSIA OR TO PERSONS IN MALAYSIA AS THE SHARES ARE NOT INTENDED BY THE ISSUER TO BE MADE AVAILABLE, OR MADE THE SUBJECT OF ANY OFFER OR INVITATION TO SUBSCRIBE OR PURCHASE, IN MALAYSIA. NEITHER THIS DOCUMENT NOR ANY DOCUMENT OR OTHER MATERIAL IN CONNECTION WITH THE SHARES SHOULD BE DISTRIBUTED, CAUSED TO BE DISTRIBUTED OR CIRCULATED IN MALAYSIA. NO PERSON SHOULD MAKE AVAILABLE OR MAKE ANY INVITATION OR OFFER OR INVITATION TO SELL OR PURCHASE THE SHARES IN MALAYSIA UNLESS SUCH PERSON TAKES THE NECESSARY ACTION TO COMPLY WITH MALAYSIAN LAWS.

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The funds have not been and will not be registered with the National Registry of Securities, maintained by the Mexican National Banking and Securities Commission and, as a result, may not be offered or sold publicly in Mexico. Robeco and any underwriter or purchaser may offer and sell the funds in Mexico on a private placement basis to Institutional and Accredited Investors, pursuant to Article 8 of the Mexican Securities Market Law.

Additional Information for investors with residence or seat in Peru

The Fund has not been registered with the Superintendencia del Mercado de Valores (SMV) and is being placed by means of a private offer. SMV has not reviewed the information provided to the investor. This document is only for the exclusive use of institutional investors in Peru and is not for public distribution.

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This document has not been registered with the Monetary Authority of Singapore ("MAS"). Accordingly, this document may not be circulated or distributed directly or indirectly to persons in Singapore other than (i) to an institutional investor under Section 304 of the SFA, (ii) to a relevant person pursuant to Section 305(1), or any person pursuant to Section 305(2), and in accordance with the conditions specified in Section 305, of the SFA, or (iii) otherwise pursuant to, and in accordance with the conditions of, any other applicable provision of the SFA. The contents of this document have not been reviewed by the MAS. Any decision to participate in the Fund should be made only after reviewing the sections regarding investment considerations, conflicts of interest, risk factors and the relevant Singapore selling restrictions (as described in the section entitled "Important Information for Singapore Investors") contained in the prospectus. Investors should consult your professional adviser if you are in doubt about the stringent restrictions applicable to the use of this document, regulatory status of the Fund, applicable regulatory protection, associated risks and suitability of the Fund to your objectives. Investors should note that only the Sub-Funds listed in the appendix to the section entitled "Important Information for Singapore Investors" of the prospectus ("Sub-Funds") are available to Singapore investors. The Sub-Funds are notified as restricted foreign schemes under the Securities and Futures Act, Chapter 289 of Singapore ("SFA") and invoke the exemptions from compliance with prospectus registration requirements pursuant to the exemptions under Section 304 and Section 305 of the SFA. The Sub-Funds are not authorized or recognized by the MAS and shares in the Sub-Funds are not allowed to be offered to the retail public in Singapore. The prospectus of the Fund is not a prospectus as defined in the SFA. Accordingly, statutory liability under the SFA in relation to the content of prospectuses does not apply. The Sub-Funds may only be promoted exclusively to persons who are sufficiently experienced and sophisticated to understand the risks involved in investing in such schemes, and who satisfy certain other criteria provided under Section 304, Section 305 or any other applicable provision of the SFA and the subsidiary legislation enacted thereunder. You should consider carefully whether the investment is suitable for you. Robeco Singapore Private Limited holds a capital markets services license for fund management issued by the MAS and is subject to certain clientele restrictions under such license.

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Robeco Institutional Asset Management B.V., Sucursal en España with identification number W0032687F and having its registered office in Madrid at Calle Serrano 47-14º, is registered with the Spanish Commercial Registry in Madrid, in volume 19.957, page 190, section 8, sheet M-351927 and with the National Securities Market Commission (CNMV) in the Official Register of branches of European investment services companies, under number 24. The investment funds or SICAV mentioned in this document are regulated by the corresponding authorities of their country of origin

and are registered in the Special Registry of the CNMV of Foreign Collective Investment Institutions marketed in Spain.

Additional Information for investors with residence or seat in South Africa

Robeco Institutional Asset Management B.V. is registered and regulated by the Financial Sector Conduct Authority in South Africa.

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The Fund(s) are domiciled in Luxembourg. This document is exclusively distributed in Switzerland to qualified investors as defined in the Swiss Collective Investment Schemes Act (CISA). This material is distributed by Robeco Switzerland Ltd, postal address: Josefstrasse 218, 8005 Zurich. ACOLIN Fund Services AG, postal address: Affolternstrasse 56, 8050 Zürich, acts as the Swiss representative of the Fund(s). UBS Switzerland AG, Bahnhofstrasse 45, 8001 Zurich, postal address: Europastrasse 2, P.O. Box, CH-8152 Opfikon, acts as the Swiss paying agent. The prospectus, the Key Investor Information Documents (KIIDs), the articles of association, the annual and semi-annual reports of the Fund(s), as well as the list of the purchases and sales which the Fund(s) has undertaken during the financial year, may be obtained, on simple request and free of charge, at the office of the Swiss representative ACOLIN Fund Services AG. The prospectuses are also available via the website.

Additional Information relating to RobecoSAM-branded funds/ services

Robeco Switzerland Ltd, postal address Josefstrasse 218, 8005 Zurich, Switzerland has a license as asset manager of collective assets from the Swiss Financial Market Supervisory Authority FINMA. RobecoSAM-branded financial instruments and investment strategies referring to such financial instruments are generally managed by Robeco Switzerland Ltd. The RobecoSAM brand is a registered trademark of Robeco Holding B.V. The brand RobecoSAM is used to market services and products which entail Robeco's expertise on Sustainable Investing (SI). The brand RobecoSAM is not to be considered as a separate legal entity.

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The Prospectus has not been approved by the Securities and Exchange Commission which takes no responsibility for its contents. No offer to the public to purchase the Shares will be made in Thailand and the Prospectus is intended to be read by the addressee only and must not be passed to, issued to, or shown to the public generally.

Additional Information for investors with residence or seat in the United Arab Emirates

Some Funds referred to in this marketing material have been registered with the UAE Securities and Commodities Authority (the Authority). Details of all Registered Funds can be found on the Authority's website. The Authority assumes no liability for the accuracy of the information set out in this material/document, nor for the failure of any persons engaged in the investment Fund in performing their duties and responsibilities.

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Robeco is temporarily deemed authorized and regulated by the Financial Conduct Authority. Details of the Temporary Permissions Regime, which allows EEA-based firms to operate in the UK for a limited period while seeking full authorization, are available on the Financial Conduct Authority's website.

Additional Information for investors with residence or seat in Uruguay

The sale of the Fund qualifies as a private placement pursuant to section 2 of Uruguayan law 18,627. The Fund must not be offered or sold to the public in Uruguay, except under circumstances which do not constitute a public offering or distribution under Uruguayan laws and regulations. The Fund is not and will not be registered with the Financial Services Superintendency of the Central Bank of Uruguay. The Fund corresponds to investment funds that are not investment funds regulated by Uruguayan law 16,774 dated September 27, 1996, as amended.

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